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CONTENTS

Outline of a stratigraphical "bridge" between the Mexico and Puebla basins

(PART TWO)

by I. W. CORNWALL

Introduction

In a former paper[1], a number of geological sections was described, mostly along the course of the new motorway between the cities of Mexico and Puebla, but extending to the south-east of the latter as far as the Valsequillo Reservoir.

That paper served to outline the project, state some of the problems and to record some of the salient stratigraphical facts, from which it was hoped to construct the outline of a succession of events for the later Pleistocene of the region and, hence, to derive a relative chronology for the known sites of early man's occupation in the two Basins.

Few conclusions, however tentative, were then possible, based on the field evidence alone: they have had to await the results of laboratory investigations on samples collected during the first season's work (January to March 1966) and of further fieldwork and sampling undertaken in the light of these results during the three months, January–March 1968.

In particular, the absolute chronological position is becoming increasingly clear as the result of dates by Radiocarbon, obtained since the first season, from several samples of the deposits here concerned and others (e.g. at the archaeological site of Tlapacoya)[2] stratigraphically relatable to them.

The study of the transect described as a result of the 1966 work gave rise to the composite stratigraphical column shown in Fig. 1.

On an 'Older Lava' forming the basis of an ancient topography of the Sierra Nevada and its foothills on the western flank, lay a thick (some 26 m. measured, not necessarily a maximum) sequence of more or less weathered fine volcanic ashes interspersed with beds of pumice, recording a long succession of local volcanic events. During the longer or shorter intervals of quiescence of the volcanic activity, sub-aerial weathering-soils were formed on their temporarily-exposed surfaces. The relative maturity of these was more a matter

[1] Cornwall, I. W., 'Outline of a stratigraphical "bridge" between the Mexico and Puebla basins', *Bull. Inst. Arch.* 7 (1967), 89–140.

[2] Mirambell, L., 'Excavaciones en un sitio pleistocénico de Tlapacoya, México', *Boletin INAH* 29 (1967), 37–41.

of the length of time elapsing between one ash-fall and the next than of an appreciable change in any other environmental factor controlling their development.

One such soil, of a deep red-brown colour, was particularly conspicuous and, because of its recurrent appearance in successive sections (Sites A to G) and its easy recognition, was called the 'Marker'-soil. Evidently this represents a relatively long period of volcanic quiescence and conveniently divides the

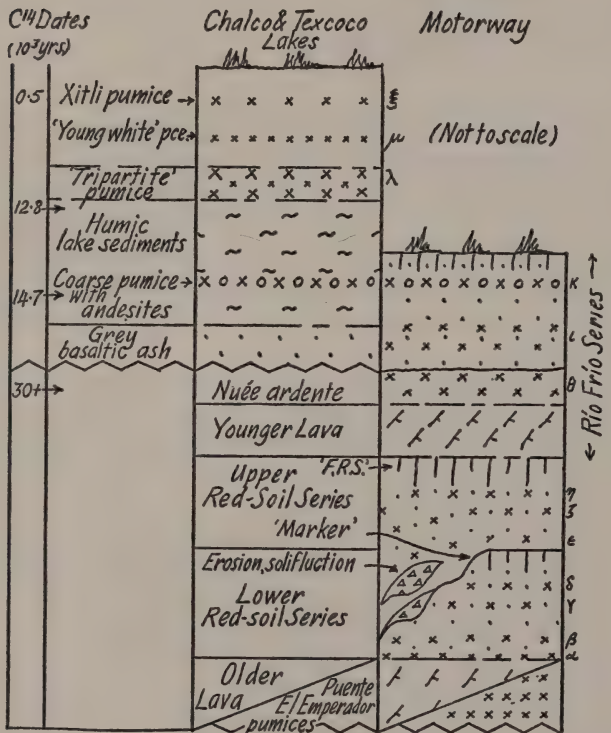

Fig. 1
Composite geological column

column into two almost equal halves, by measurement, and into two series of geological and environmental events—these, of course, not necessarily occupying even approximately equal spans of time.

Above the 'Marker', a further series of ashes and pumices was described, displaying several weathering-horizons, generally ending with another well-developed reddish soil, known, from its having been the first such noted in working down from the modern surface, as the 'First Red Soil' (F.R.S. for short).

At a point on the motorway, on the western flank, close to the present-day lower margin of the pine-forest (Km. 32)[3] a Younger Lava overrode the entire series hitherto described and hid it from view as far as the summit of the pass, at an altitude of just under 3,200 m., and for some distance beyond.

At the small town of Río Frío, an impressive deposit (up to 20 m. exposed, base unseen) of an andesitic *nuée ardente* locally buried the 'Younger Lava' in its turn and on top of this again was developed a relatively thin covering (no more than about 5 m. seen anywhere) of loose ashes, subdivided by thin beds of pumice and immature soils of forest-brownearth character, like the modern. This was called the Río Frío Series and begins with the lava and the overlying *nuée*, which, for some distance on both flanks of the Sierra, in the higher parts of the motorway, provides another readily recognizable marker-horizon. The *nuée* is now known to be bipartite, with a very thin immature brown soil separating the two divisions. Both parts contain carbonised wood.

Beyond Río Frío, now on the eastern flank, red soils again appear, beyond the extent of the 'Younger Lava', exhibiting a sequence similar to that already noted, and remain exposed at intervals, in part at least, as far as Km. 58 on the motorway (Site N) where, close to Puente el Emperador, they overlie a thickness of several tens of metres of pale grey stratified pumices and ash, the relation of which to the 'Older Lava' noted on the western flank remains unknown. As will later appear, this last relation is irrelevant, so far as concerns the present study.

Soon after Puente el Emperador, the red-soil series disappears, for nearly 40 Km., beneath thick deposits of mudflows and more recent slope-washes and stream-alluvia. Until about Km. 99 nothing similar is clearly exposed anywhere along the roadway, though there are scattered indications in natural erosion-gullies nearby (Sites O and P) that they do continue underneath this cover.

Near the Puebla end of the motorway (Sites Q to U, inclusive, between Kms. 102 and 110), some red soils were seen, mostly in natural gully-sections. These were associated with qualitatively different pumices, in another stratigraphical sequence, often topped by mudflows and fluviatile alluvia of the R. Atoyac. The alluvia belong to at least two terraces older than the present flood-plain. It was impossible to correlate these deposits with the former sequence on any stratigraphical basis.

[3] At the time (1966) of the first season's fieldwork, temporary kilometre-posts were in position all along the motorway and these made location of the sites described conveniently easy. Distances were measured, eastwards, from the beginning of the motorway, near Los Reyes, and these are shown on the plan (Fig. 1), published in Part I of this work.
In 1968, the temporary posts at each kilometre had been removed and replaced by (many fewer) permanent indications, on which, however, the distances had been measured, not from the beginning of the motorway proper, but from a point (? the 'Zócalo'—Plaza de la Constitución) in the centre of Mexico City itself.
The distances given in Part I, and, for uniformity's sake, used here also, must therefore be increased all along by 15·5 km. to correspond with the new kilometre-posts on the road itself.

On the north flank of the Cerro de Loreto, just north of Puebla (Site W), and again in a series of deep gullies on the Tetela Road near the Valsequillo Reservoir (Site X) and at the archaeological site of Hueyatlaco (Site Y), on the Tetela Peninsula, by the reservoir shore, a third sequence of deposits was noted, having fairly close qualitative and stratigraphical resemblances *inter se*, but uncorrelatable by field-evidence alone with the motorway sections.

Back on the Mexico side of the Sierra, the connection between the motorway sequence of red soils and the lake deposits with intercalated volcanics, associated with the archaeological site at Tlapacoya (Site Z), was equally problematical. It was evident that the red soils, conforming closely to the ancient topography beneath, dipped down underneath the almost horizontal deposits of the recent Lake Chalco, which was artificially drained only in 1910. Only a deep boring, somewhere well out in the Chalco Basin, would clearly define their relationships.

There was, however, one notable feature, common both to the lacustrine sediments and to the Río Frío Series of terrestrial deposits—a prominent deposit of coarse pumice, with lapilli up to 4 cm. in diameter, including similar-sized fragments of solid andesite rock. From its known distribution in the mountains, this probably emanated from Popo. and takes its place in the pumice-series as Pumice κ. Though this was not the only pumice-with-andesites known (for there was another well-developed example—Pumice ζ, Site F—about three-quarters of the way up from the base of the motorway sections), it was the only possible correlative of the pumice-with-andesites of the Texcoco and Chalco lake-deposits, and corresponded with those in every way. In the mountains, this pumice generally occurs close beneath the modern surface, or, on the eastern flank of the Sierra, near the base of Popo., under a thin (up to 1 m.) cover of loose yellow ash.

At Tlapacoya II[4], this pumice occurs between layers of humic lake-clays which have given C–14 dates of 14,700 $\pm$ 280 and 12,800 $\pm$ 240 years before present. Since the pumice lies directly on the former, its date may be accepted as being closer to the higher of these figures, and this date may be transferred to a point stratigraphically close to the summit of the Río Frío Series.

Another fixed chronological point is the Río Frío *nuée*, at the base of the Series. This was dated directly by its contained, and obviously *in situ* carbonized tree-trunks to 30,000+ years B.P. This is only a limiting figure in the upward direction. It cannot be younger than 30,000, but might be *very much* older. An independent sample taken by H. Malde[5] gave a date of 40,000+ B.P. for the same material. Since the *nuée* covers the 'Younger Lava', which in its

[4] Mooser, F., 'Tefracronología de la Cuenca de México para los últimos treinta mil años', *Boletin INAH* 30 (1967), 12–15.

[5] Malde, H. and Irwin-Williams, C., 'Preliminary reports on radio-carbon dates from the Valsequillo area Puebla, Mexico', cyclostyled communication, Peabody Museum of Archaeology and Ethnology, Harvard University (1967).

turn overlies the whole of the red-soil series, this last looks likely to be much older again, but not, as far as concerns its upper parts, very much so of necessity, for both Lava and *nuée* represent essentially instantaneous events in geochronological terms.

Some theoretical considerations

Before proceeding further with an account of the second season's work in Mexico and of additional results obtained, it will be worth while to take stock of the situation and to enumerate some considerations of importance to any interpretation attempted on the basis of such results and the existing stratigraphical data.

(1) The fundamental premise on which consideration of soil-phenomena is here based is that, while volcanic parent-materials may vary considerably from place to place within a fairly short distance, the climatic factor in soil-formation will be constant over a very wide area, so that soils which may be assignable to a single period of particular climatic conditions should, where preserved, be equally widely recognizable, and so serve as stratigraphical units enabling correlations to be made from place to place.

(2) This first premise is subject to the caveat that, since we are dealing with a long transect crossing a high mountain pass some 1,000 m. in maximum altitude above its two ends, some considerable local variation in the climatic factor is to be allowed for at any given point in times past, as is the case at the present day. Río Frío, for example, near the summit of the pass, has a present-day climate of considerably wider extremes of temperature and a much higher precipitation than the valleys on either side. Owing to its slightly lower altitude and to the rain-shadow effect of the Sierra, with present-day prevailing westerly winds in winter, the Puebla valley is distinctly warmer and drier than that of Mexico. Contemporary soils do, in fact, reflect these differences, the characteristic types being Para-Chernozem with a well-developed Ca-horizon at lower altitudes (about 2,250 m.) and Eutrophic Braunerde in the forested belt above about 2,750 m.

(3) (i) Parent material and (ii) climate do not, alone, determine the character of a soil, though they are generally the dominant factors. The effects of the other three factors of soil-formation[6] cannot safely be ignored. In particular cases any one may outweigh both of the first two.

(iii) Exposure, i.e. orientation, slope and topographical influences generally, are obviously important in mountainous country, as affecting the microclimate of any particular place.

(iv) The biological factor—vegetation and fauna—may well have been very different in the past from what we find today and so have had a proportionate influence on the soils.

[6] Jenny, H., *Factors of Soil Formation* (New York, 1941), 281 pp.

(v) Time is clearly of the utmost importance in influencing the character of a soil, especially when we may, in the case of Pleistocene soils, be dealing with time-spans to be measured rather in millennia than in centuries.

(4) Regarding volcanic ashes, etc. as parent-materials for soils, they do not, in this region, differ very widely in the chemical sense, for all are in the range of basic-intermediate to basic rocks—andesite to basalt—but they vary enormously in physical properties, from dense lavas to highly porous pumice-beds, with all grades of more or less compact sandy to silty ashes in between. Fresh volcanic ashes are conspicuously low in the proportion of clay-grade constituents. These increase notably after some degree of weathering. Soils forming on the looser and more finely-divided pyroclastics will evidently attain a certain degree of maturity more rapidly than those on lavas, but the end-products, other things being equal, are unlikely to be widely different, their physical and chemical features being mainly due to the character of the climate under which they were formed.

(5) In a volcanic region such as ours, a land-surface on which a soil was forming may often have been buried by a fresh fall of pyroclastic material. If deep enough—say 50 cms. or more—this cover will have isolated the former surface from direct atmospheric and biological influences and converted it into a 'fossil'. The buried soil will have undergone no important further change, unless once again involved in soil-forming processes, by erosion of the cover or growth in depth of a mature weathering-profile which started at the new surface.

The fresh mineral cover will at once begin to weather and to form a soil, which, given time, and if there is no change in the other environmental factors, will be a duplicate of that on the buried surface. Its degree of maturity, however, may be very different, and this will depend solely on the time during which the soil-forming factors were free to operate since the fall of its parent-material and before another such volcanic incident buried it, in its turn,

The two main red-soil forming phases described here, those of the 'Marker' and the 'First Red Soil' respectively, are, thus, generally represented by multiple buried weathering-horizons, the number and maturity of which at a given site depends only on the number of ash-falls experienced at that place, and their timing.

(6) *Redistributed ash—"Ehecanexpa"*. A striking feature, in thin sections, of many of the primarily pyroclastic subaerial sediments here described is a slight, but distinct, degree of weathering of their materials, evenly distributed throughout their thickness, i.e. not exhibited as distinct soil-horizons formed by the penetration downwards of weathering processes from a stable surface.

A case in point is the thick cover, often seen on the 'Younger Lava' near the top of the pass at Río Frío, of up to 5 m. of still-loose, silty ash of a uniform yellow-buff colour, representing the Río Frío Series, but generally without appreciable internal stratification or subdivision.

Another is the striking yellowish grey 'crumbly clay' at Sites, W, X, Y and Arenillas, all at the Puebla end of our transect. This is uniformly peptized (with hydrous colloids in all the finest interstices) throughout its thickness of 3–4 m.

The yellowish colour, in all cases, is due to the presence of limonite, $2Fe_2O_3.3H_2O$, hydrated ferric oxide, and this is undoubtedly the result of some oxidation and hydration of originally solely ferr*ous* minerals and glasses in freshly-fallen ash.

Since there are often no distinct weathering-horizons or soil-profiles in these materials, it appears unlikely, as has been suggested, that their parent ashes fell, issuing directly from the vent, in small amounts, fairly continuously over long periods of time, so that weathering throughout of each fall could take place *in situ*. Any such fall, slightly thicker than the rest, weathered briefly *in situ* and quickly covered by the next, would inevitably present distinct horizons: its upper part more or less weathered, the lower remaining fresh and unaltered. A more likely explanation is that such thick beds are formed by the repeated deposition, in small amounts over a period of many years, of wind-eroded and -transported dust, already somewhat weathered on the surface from which it was derived.

A major ash-explosion from a volcano may cover its immediate surroundings to some depth, burying and killing any vegetation but the taller trees. Weathering begins of the free surface, but such bare expanses of loose ash are susceptible to wind-erosion in the more exposed situations and the partly-weathered surface layers would be likely, from time to time, to blow away and be evenly redistributed, often at great distances, over the surrounding country, especially among growing vegetation at lower levels. The presence of root-holes throughout most of such deposits shows that they were continuously covered by growing plants during their gradual accumulation. In this, as in other features, they greatly resemble loess—which, of course, has totally different origins, though the mechanism of its deposition is the same.

Dust from different expanses of ash *in situ* would probably be redeposited at different times in the same place, thus inextricably mixing any minerals characteristic of the original ashes. The action of growing roots and the activity of contemporary burrowing animals, as well as local blowing of still-loose ash and slope-washing, would, in time, ensure a complete mixture of available constituent grains.

In situ subaerial ash-falls are, as this study shows, a comparative rarity, though they do often occur among lacustrine sediments. Pumices *in situ* are, however, common, and this is clearly due to their sandy (or coarser) texture, the relatively large size and mass of their individual particles preventing their ready disturbance, redistribution and mixing by wind alone.

Wind redistribution thus seems to be the most probable explanation of a very widespread and common phenomenon in volcanic regions. Similar deposits of ash have been described from New Zealand, but the material does not figure in the textbooks as a defined entity. It is here called 'redistributed ash', but that term does not include reference to the very constant feature of its slight degree of uniform weathering, gradual accumulation and even distribution. A one-word term, defined to include all the salient features of the phenomenon would be preferable. This should not be in a language in common geological use, but in one (as, for instance, in the cases of 'loess' or 'lahar') taken from an area where it is typically displayed, usable as a technical term in any language, without translation.

'*Ehecanexpa*' (*Ayhaykanéshpa* in English transliteration) means 'wind-ash' in Nahuatl, and is suggested as such a term. It is defined as volcanic ash of predominantly silt-grade particles, partially chemically weathered and gradually accumulated, without apparent stratification, as air-borne dust, derived by wind-erosion from the place of its original fall. Though, because it is weathered, it may have some features of a soil, it is in no sense a soil *in situ*, but only 'conflated' (on the analogy of 'colluviated') immature soil-material. Once its deposition is halted and its surface stabilized by vegetation, it often provides parent material for development of the distinct horizons of a true soil-profile, weathering downwards from a free land-surface.

(7) Particular volcanic deposits may themselves be identifiable over considerable distances: (a) by their stratigraphical relationships to each other and to soils formed on them during quiet intervals; (b) by their intrinsic physical, chemical and mineralogical properties.

There is cause for a good deal of caution in making identifications and correlations under the second head, for the following theoretical reasons:

(i) The same volcanic vent may, at different times, perhaps even within a single eruptive phase, emit pyroclastic materials of very different physical, chemical and mineralogical properties.

(ii) Conversely, the emissions of different vents at different times may be exceedingly alike, so that they may easily be mistaken for products of the same incident.

(iii) The character of the deposits attributable to a single volcanic explosion may differ widely from place to place, depending on their distance from the vent. The coarser fragments will fall from the explosion-cloud close to the vent, the finer particles often some tens, or even hundreds, of miles away. The sorting process during their passage through the air may not be confined to particles of different average grain-size only, but may equally affect those, for instance, of greater density, of which the rate of fall will be faster than that of the less dense. This will apply, for example, to solid phenocrysts of ferro-magnesian minerals, as compared with vesicular pumice and ash of a glassy

character. The particular crystalline habit of phenocrysts, such as biotite, characteristically platy, will cause them to fall out of a fluid suspension (air or water) more slowly than globular-shaped particles of equal weight, owing to their greater surface-friction with the medium.

(iv) The distribution of ash, etc. from a volcanic explosion will be equal (forming a true circle round the vent) only in conditions of absolute atmospheric calm. Any wind blowing at the time of the eruption will extend the area of distribution of the emitted materials down-wind, in a more or less elongated ellipse, depending on its velocity and the average particle-sizes concerned and their rates of fall-out. Wind at some considerable height above the vent may be quite different in direction and velocity from that prevailing at the surface. In the case of the more violent volcanic explosions, projecting solid particles to a height of thousands of metres above the vent, the distribution of the products of a single explosion may be in double ellipses, or some even more complex and unpredictable figure, owing to local circumstances.

The identification and correlation of pyroclastic volcanic deposits in different exposures, especially if widely separated in distance from each other and from the vent, is thus fraught with difficulties and uncertainties owing to the many unknown and unestimatable factors—such as the wind direction and velocity at some point in time in the remote past.

(8) The volcanic deposits and ancient buried soils formed on them with which we are here concerned lie conformably on a very ancient eroded topography, i.e. dip down with their stratification more or less parallel with the pre-existing valley-sides. They are exposed by modern artificial road-cuttings or in natural erosion-gullies of fairly recent formation, which cut, often, with very steep, even vertical, walls, into the old weathered valley-fillings.

One notable feature of these deposits is the rarity (at least in the available sections) of manifest phases of erosion intervening between those of deposition. From the 'Older Lava' up to the base of the Río Frío Series, important erosional disconformities have been observed so far only in very few exposures. Those that are to be seen evidentally represent environmental changes of some amplitude, disturbing the otherwise almost unbroken régime of alternating sedimentation and soil-formation, which, it would seem, prevailed during most of the time over a very long period.

This stability is in complete contrast with the present-day state of affairs, in which deep gully-cutting and denudation of all eminences is everywhere in evidence, far outstripping sedimentation everywhere save in the floors of the Basins.

(9) Just as the balance between sedimentation and denudation in the past was very different from that obtaining at the present day, the intrinsic characters of the ancient soils point to contemporary environmental conditions in absolute contrast with those of today. They are all somewhat highly coloured

(yellow to red), dense, loamy soils, low in organic matter, showing intense chemical weathering, completely decalcified and mostly rather distinctly acid in reaction. The modern soils in comparable situations invariably reflect the existing sub-arid climatic régime, with a prolonged dry season at the lower altitudes. They form grey to dark-grey incoherent sandy friable soils with much humus, of the Para-Chernozem type, with a well-marked horizon of carbonate deposition (caliche) in veins and concretions at depths down to 2 m. below the surface.

Nothing similar has anywhere been seen in the ancient deposits here studied. We may start, therefore, with a firm indication that the type of environment which the buried soils represent was quite different from what we see today.

Sampling

In the first season's fieldwork, the only indications as to the nature of the deposits and soils described were visual, stratigraphical and qualitative—so far as characters could be determined on the spot with the aid of the natural senses, an acid-bottle and a hand-lens. Any conclusions could thus only be provisional, based on personal experience, and necessarily including a fairly large subjective element dependent on the observer.

In order to give more detailed, factual and quantitative answers to the manifold questions that arose as the fieldwork proceeded, samples of some of the deposits were taken (about 100 in all) and these were submitted to laboratory examination as to their physical, chemical and mineralogical properties. Those thought, from the field evidence, to represent weathering-soils, or the parent materials of such, were, in addition, thin-sectioned by Mrs. M. Barton, at the London University Institute of Archaeology, London. A well-established technique[7] was used for their preparation. They were then examined by the writer under the polarizing microscope, to determine their micro-structures and the distribution within their fabrics of colloidal materials. Interpretation of the micromorphology follows the principles laid down by Kubiëna[8].

The petrological work was carried out in Mexico by Ing. A. Sotomayor, to whose technical skill and valuable advice in personal discussions the writer here pays grateful tribute.

The mechanical analyses for particle-size distribution were carried out in the soil-laboratory of the Department of Prehistory, Instituto Nacional de Antropología e Historia, Mexico City, often personally by, but at least under the direction of, Sra. Francisca Torres, as were the lengthy and numerous chemical determinations on the entire collection of samples. Further advance would have been impossible without the valuable help of all concerned.

[7] Cornwall, I. W., *Soils for the Archaeologist* (London, 1957).

[8] Kubiëna, W. L., *Soils of Europe* Consejo Superior de Investigaciones Científicas of Madrid (London, 1953).

A list of the sites will be found in Appendix A.

A register of the 1966 samples figures as Appendix B.

One series was taken, from Sites A to D, on the motorway, sampling every distinctive horizon at a point where it was most accessible.

Another series was taken at Site X, Valsequillo.

The object of the sampling was not only to investigate weathering-horizons but to characterise the sediments themselves. Beyond the fact that they all consisted of pyroclastic volcanic materials, the manner of their transport and deposition was in many cases—especially at Valsequillo—far from clear and the cause of some differences of opinion among interested colleagues who had seen the sections.

In addition to these two main series of samples, some details appearing at related, or possibly related, sites were sampled for comparison, among these the whole range of pumices at Sites K and L, beyond Río Frío. These seemed accurately to repeat the entire sequence observed at the type-sites A to E, but now occurring on the eastern flank of the Sierra, and would provide valuable corroboration if showing similar properties.

All the samples were examined for distribution of particle-sizes (mechanical analysis) by the well-known hydrometer method, for pH, content of organic matter and the proportions of acid-extractable CaO, MgO, FeO and Fe_2O_3, thus excluding bases still combined as unweathered silicate-minerals.

Results have been plotted as 'curves', for more ready visual comparison between samples, of the whole range of quantitative properties investigated (Figs. 2 and 4).

Ing. Sotomayor made descriptive mineralogical analyses of the samples, and, in addition, determined the position of the characteristic plagioclase felspars in the albite/anorthite scale and the refractive indices of the chief glasses found. He plotted these two quantities against each other, the resultant diagram (Fig. 4, below) enabling easier comparisons to be made between individual samples in respect of these mineralogical features.

Mechanical analyses

A priori, one would expect fresh pumices to be sandy, ashes to be silty (neither having a high proportion of clay) and soils formed on either to have a higher percentage of clay than their respective parents, formed by chemical decomposition of coarser grains, at the expense of the sand and silt grades.

Recognition of soils and the assignment of the deposits to one or other of these classes in the field was necessarily somewhat subjective, based on macroscopic texture and colour in comparison with adjacent materials. To test the general validity of these first conclusions at the sites in question, average particle-size distributions of a number of samples in each class were computed, with the results given in Table i.

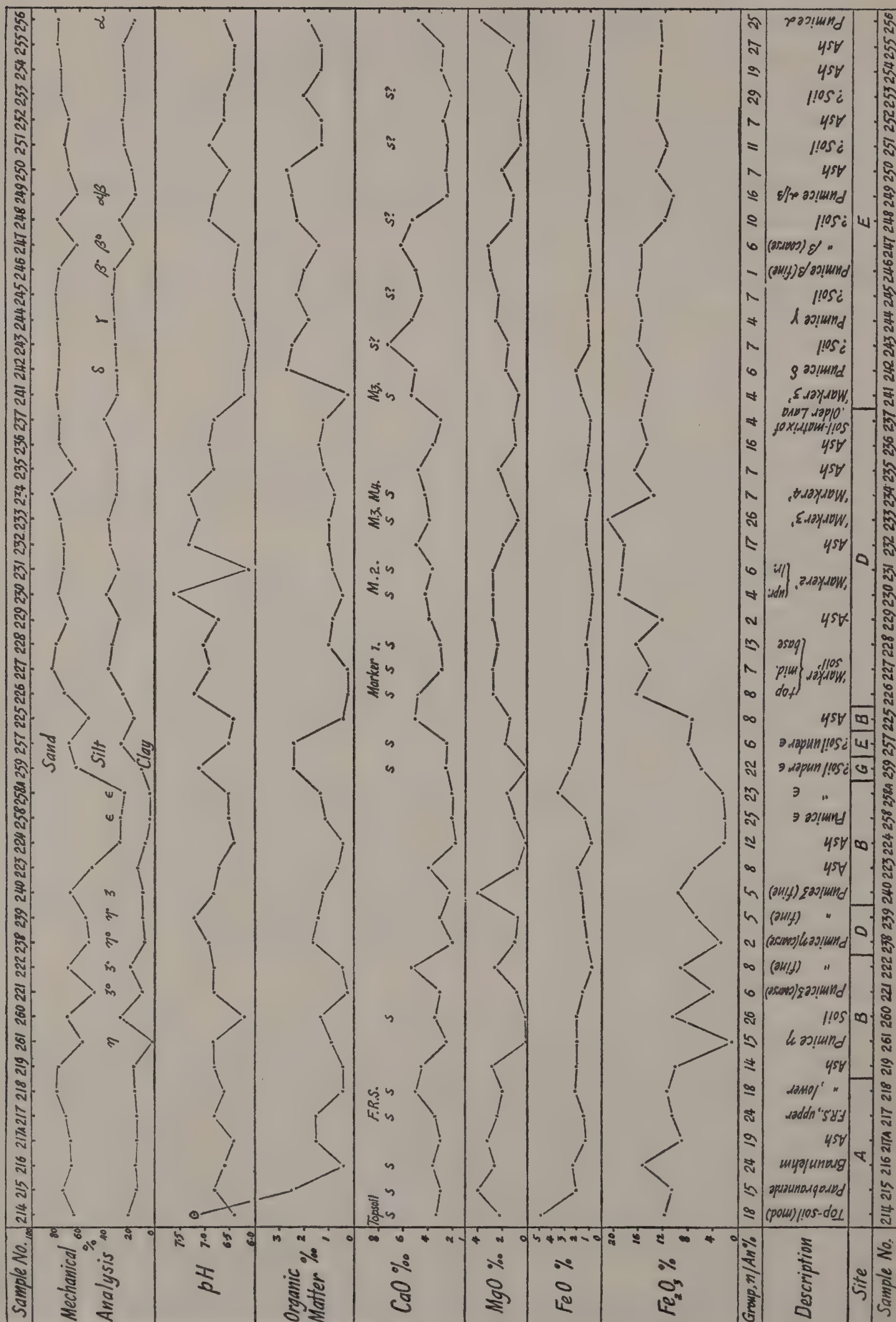

Fig. 2 Motorway Samples. Analytical results

TABLE i. MECHANICAL ANALYSES, SITES A–E

Material	No. of samples	Sand % (2.0–0.06 mm.) Average	Sand % Extremes	Silt % (0.06–0.002 mm.) Average	Silt % Extremes	Clay % (<0.002 mm.) Average	Clay % Extremes
Above 'Marker'							
Pumices	7	55	30–77 (range 47)	37	20–50 (30)	8	3–20 (17)
Ashes	5	43	30–73 (43)	44	23–70 (47)	13	4–18 (14)
Soils	7	29	22–37 (15)	53	43–61 (18)	18	10–28 (18)
'Marker' and below							
Pumices	6	32	23–49 (26)	46	36–68 (32)	22	8–32 (44)
Ashes	8	28	22–38 (16)	45	32–51 (29)	27	18–35 (17)
Soils	13	23	18–29 (11)	47	40–51 (11)	30	23–38 (15)

Owing to their obviously more advanced state of weathering, averages for samples of the 'Marker' and layers below it were calculated separately from those of the much younger and fresher materials above it. It is clear from the figures that the general conclusions were, on the whole, correct.

Pumices in both series were, on average, coarser in grade than ashes and these than soils, which were marked by the presence of a higher average clay-content. The decreased sand-grades and much higher proportions of clay in all deposits below the 'Marker', in comparison with those above it, point to their more advanced state of alteration by weathering: nevertheless the putative soil-horizons are again distinguished from the less weathered pumices and ash by showing an average percentage of clay clearly higher than either, with a corresponding loss of sand-grade materials. The extremes and the ranges of variation given show that there is very considerable variation, however, between individual samples. This range is highest in pumices, least in soils and smaller in most cases in the group below the 'Marker'. This is clearly a measure of the degree of chemical alteration, which, given time, would tend to reduce all these varied pyroclastic materials to a rather uniform type of loamy clay, resembling, for instance, Sample No. 237, the matrix between the 'Older Lava' boulders.

Looking into matters more closely, we may compare the three pumices, (ε, ζ and η, in ascending order) occurring above the 'Marker' and below the 'First Red Soil':

TABLE ii

Pumice	*Site*	*Sample No.*	*Sand %*	*Silt %*	*Clay %*
ε	B	258	74	23	3
ε	B	258A	77	20	3
Ash above ε	B	224	73	23	4
ζ	B	221	51	29	10
ζ	B	222	30	50	20
ζ	B	261	62	36	2
η	D	238	48	45	7
η	D	239	46	44	10

All save No. 222 have remarkably low clay-contents and, especially in the case of ε, high sand-fractions. No. 222 represents the lower part of Pumice ζ at Site B and, on this showing, seems to have suffered some weathering *in situ* before the deposition of the second layer of material over it. This conclusion is borne out by the chemical results (see below).

In contrast, let us look at the pumices below the 'Marker', *α–δ*, in ascending order:

TABLE iii

Pumice	*Site*	*Sample No.*	*Sand %*	*Silt %*	*Clay %*
α	E	256	24	68	8
α/β	E	249	49	37	14
β	E	247	48	36	16
β	E	246	23	45	32
Ash between β and γ	E	245	21	46	33
γ	E	244	23	45	32
Ash between γ and δ	E	243	24	46	30
δ	E	242	24	46	30

Pumice α, the oldest of all, lying directly upon the 'Older Lava' at the base of the section, is almost loess-like in analysis, with more than two thirds of its bulk consisting of silt. This is, clearly, a fresh, airborne sediment at some distance from its source, to judge from the small proportion of sand.

Pumice β is sandier below, but has suffered some weathering in both samples. Its higher part (No. 246) has an analysis identical with that of the next in succession (Pumice γ, No. 244), a fact which makes one refer to the thin intervening 'ash' (No. 245). This proves, though slightly less sandy, to be very like both. The same applies to the 'ash' between γ and *δ*, which has a grading identical with that of the latter and very closely like that of the former. These are all considerably weathered ash/pumice mixtures and probably belong to the same volcanic event, or closely sequent series of events. The chemical determinations, though not identical throughout, do nothing to gainsay this conclusion. They merely point to minor weathering of varying degrees at the different horizons, marked by variations in content of organic matter and weatherable bases. Their distribution among the mineral groups (Fig. 4: 1, 4, 6, 7) supports a close relationship.

Sample No. 249, from the lower part of what appeared to be an immature weathering-soil immediately below No. 247 (Pumice β), proves to be so like the latter that it is probably to be associated with it, though clearly separated from it by some time-interval during which its upper part (No. 248) was somewhat weathered, with loss of sand and increase in the clay-fraction.

Comparable pumices

For convenience of comparison, the laboratory results for all pumice-samples, wherever collected, are grouped together in a single diagram (Fig. 3). Those already discussed, the 'type'-series, appear again here, but in juxtaposition with their presumed stratigraphical correlatives from Sites K and L. These are situated beyond Río Frío, on the eastern flank of the Sierra, some 20 km. distant, as crows (and pumices!) fly.

Considering, for the present, only the mechanical analyses, there are some obvious and interesting differences in grading between correlatives. Samples from Sites K and L of Pumices α and β are consistently sandier and contain less clay than those from Sites A to E, suggesting that they have travelled less far, i.e. are closer to their (?respective) explosion-vents. (The identities of these are, at present, quite unknown, but they should be locatable by an extension of studies like the present to numerous samples collected from a much wider area).

Going on to Pumices γ and δ: these show only slight differences, as has already been indicated above, but, once more, Site L samples are consistently, if only slightly, sandier than those from Site E. Both are much more weathered than Pumices α and β, as may be seen from their greater clay-contents.

Pumice ε is exceedingly fresh at both sites, by contrast; ζ less so, and more varied in grading.

Pumice η is, again, relatively fresh, as its low content of clay shows; the two samples from Site D.2. show more alteration than those from Sites B and L, and this must be a matter of local topography or exposure, since the differences in altitude are unimportant—indeed L is slightly higher than either B or D.

The Río Frío *nuée* (Pumice θ) is not represented at Sites A to E. The two samples shown here are from sites less than 1 km. apart, on either side of the village. The difference in weathering is due to exposure. No. 262 is covered and protected by 3–4 m. of Río Frío Series deposits, while No. 264 lies at the modern surface.

The final group figuring in the diagram is of pumices containing biotite (rather more acidic than the others) collected at the far end of the transect, near Puebla. They share both physical and chemical family likenesses. The two least sandy (Nos. 300, 302) are not *in situ*, but were laid down in water, which fact probably accounts for the differences in grading, among others. From the

presence of one of these (No. 300) stratigraphically above the archaeological and palaeontological horizons at Hueyatlaco (Site Y), they are thought to be younger than any of the rest, which must be of a date at least 30,000+ years B.P., or considerably older. This date, it will be recalled, was obtained from Pumice θ, the Río Frío *nuée ardente*.

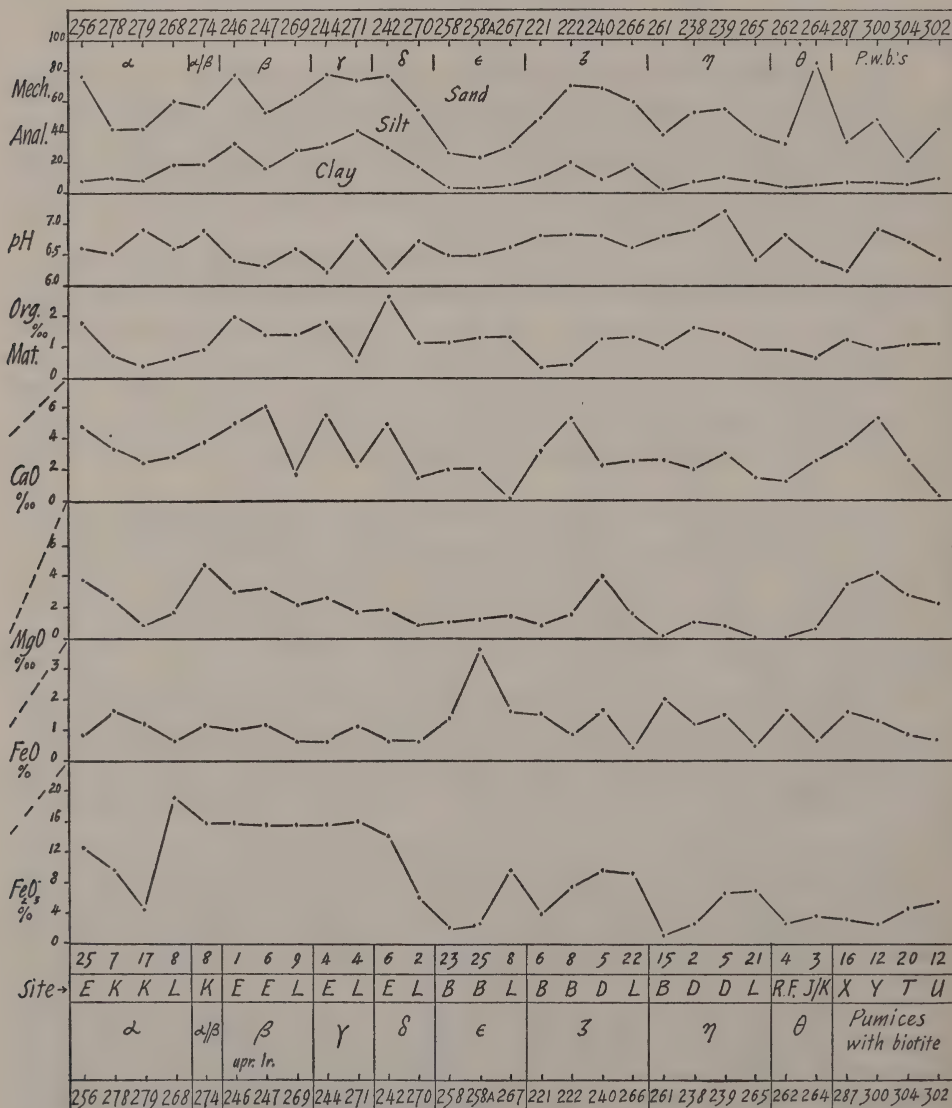

Fig. 3 All pumices. Analytical results

Chemical analyses

Returning, now, to Fig. 2: the plotted variations in chemical results are not very informative at first sight. A test, like that summarized in Table i, was made of the results for four important chemical properties, in order to discover whether any were particularly significant for distinguishing and characterizing weathering-surfaces and the resulting soils among adjacent, supposedly relatively unaltered, coarser and finer pyroclastic materials. The average values and extremes of variation are given in Table iv.

TABLE iv

Material	*No. of samples*	pH Av.	pH Extremes	Org. matter % Av.	Org. matter % Extremes	CaO % Av.	CaO % Extremes	Fe_2O_3 % Av.	Fe_2O_3 % Extremes
Above the 'Marker'—Sites A to E									
Pumices	8	6·8	6·5–7·2 (0·7)	1·03	0·21–1·63 (1·42)	3·16	1·96–5·32 (3·36)	4·68	1·1–9·72 (8.62)
Ashes	6	6·6	6·4–6·8 (0·4)	0·69	0·41–1·86 (1·45)	3·69	1·68–5·04 (3·36)	8·01	2·16–12·22 (10·06)
Soils	7	6·6	6·2–7·1 (0·9)	1·56	0·43–2·50 (2·07)	3·59	2·52–3·64 (1·12)	10·36	8·00–15·46 (7.46)
Below the 'Marker'									
Pumices	5	6·3	6·2–6·6 (0·4)	1·96	1·43–2·66 (1·23)	5·20	4·76–6·16 (1·40)	15·09	12·62–16·88 (4·26)
Ashes	8	6·8	6·4–7·3 (0·9)	1·40	1·02–2·66 (1·64)	3·38	2·24–5·04 (2·80)	14·34	12·52–18·76 (6·24)
Soils	13	6·9	6·1–7·6 (1·5)	1·07	0·21–2·46 (2·25)	3·80	2·24–5·32 (3·08)	15·24	10·70–21·58 (10·88)

One might expect a weathered soil on fresh volcanic ash or pumice to show some loss of bases, marked by a fall of pH, an average content of organic matter consistently higher than in unweathered materials, lower CaO and higher Fe_2O_3 than these. This at least would be the case in the humid cool-temperate zone, and is probably so in central Mexico also, in the case of soils high enough in the mountains to experience relatively low temperatures and all-the-year-round precipitation. At the altitudes from which the present set of samples comes (2,500–3,000 m.) we are, climatically, in at least the subtropics, with (at the present day—not necessarily in the past) a marked long dry season. The differences expected by a worker with experience mainly of soils of cool-temperate climates, do *not* stand out in the analyses.

Above the 'Marker', the pH-values show no significant fall save in No. 260; organic matter is, on the average, only fractionally higher, there is neither perceptible impoverishment nor enrichment of calcium, but ferric oxide shows some slight increase over that contained in less weathered materials.

Below the 'Marker', the figures are much the same, save for a perceptible increase of calcium, with a fairly narrow margin of variation, in the small collection of pumices. Even Fe_2O_3 is not significantly higher, on the average, in soils than in pumices and ashes, though it shows wider variation.

This rather surprising uniformity of chemical characters, despite the very striking macroscopic appearance of some of the soils concerned, as compared with their surroundings in the field, is hard to explain. It must be that the process of weathering in this environment has liberated from decomposing silicate minerals a quantity of bases just sufficient to balance their eluviation by percolating water. That such eluviation must have taken place during weathering is shown by the absence of accumulation of, for instance, calcium, in the form of carbonate (caliche), which, apart from its obvious macroscopic appearance as veins or concretions at some level in the lower part of the profile, would have raised the pH to a value of about 8·4—far above that of any sample here examined. Iron has, of course, accumulated, especially in all the materials of the 'Marker'-soil and below, because in no case has the pH fallen as low as 5·6, the value at which, *in vitro*, ferric hydroxide begins to go into true solution and be eluviated, as in a podsol. It has accumulated in almost all the materials—not only, as might be supposed, in those presumed to be parts of soil-profiles. It may perhaps be, therefore, that, in such relatively porous materials, the chemical effects of weathering extend to a very considerable depth below the manifestly-weathered (highly coloured) portion of the profile. It results that, in most cases, these chemical analyses are less useful for characterizing a soil than were the particle-size analyses, which, by the proportionate increase in the clay-fraction, point unmistakably to a result of chemical alteration of the original airborne sediments.

In Fig. 2, the more striking reddish weathering soils above the 'Marker' are represented by Samples Nos. 217, 218 ('First Red Soil', A- and B-horizons respectively); 260, a well developed soil below Pumice η at Site G; 257 and 259, another soil, beneath Pumice ε, sampled at both Sites E and G. A representative ash is No. 219, the presumed unweathered parent-material of the F.R.S.

This last shows a pH near to neutrality, low organic matter and relatively high bases throughout, though the fairly high ferric-iron figure shows that it cannot be regarded as *un*weathered, free limonite being totally absent from fresh igneous rocks. It may, nevertheless, be regarded as *relatively* unweathered, in comparison with the soils which we are investigating. (See para (6), p. 6).

Nos. 217, 218 (the F.R.S.) show pH's distinctly acid, appreciable organic matter only in the former (A-horizon), rather high calcium in the B-horizon corresponding with a slight reduction in the A, MgO and FeO are also small. Fe_2O_3 shows a slight increase in the B-horizon.

No. 260 is very close to these in character, save that calcium and magnesium are unusually low. The latter is, in fact, below the level of accurate determination b the method in use.

Nos. 259 and 257 share the same characteristics in slightly different degrees, in particular having a fairly high organic content.

The 'Marker', a soil that can be identified in the field with the naked eye from a distance of more than 500 m., was the greatest disappointment in its chemical characters. The uppermost and best developed profile (M.1.) is represented by three samples from the Site D section. No. 226 is the characteristically pink-coloured summit. No. 227 comes from about 25 cm. below, in the middle of the dark red part of the profile and 228, at about 75 cm. below its summit, is still in material distinctly red in colour.

The pH's were all close to, or just on the alkaline side of, neutrality. Organic matter in the first two was lower than in any other sample in the diagram, save only for a very fresh pumice (ζ, 221) and one of the 'Markers" own subsidiary members (241, M.3, Site E). Another sample of this last (233), from Site D, showed about as much organic matter as the modest and unremarkable quantity in No. 228, the deepest sample from the M.1 profile.

One can only suppose that the 'Marker' Series represents a moist-tropical environment in which chemical and biological activity in the soil was so intense that little or no humus escaped destruction *pari passu* with its formation. It is, in this feature, in marked contrast to the next soil above (Samples Nos. 259, 257) already noted.

Less mature members of the 'Marker' Series, to the number of at least three or four, are found below it at different sites. They are designated M.2, M.3, M.4, etc. represented here by Samples 230, 231 (M.2), 233 and 241 (M.3) and 234 (M.4). No. 231 is distinguished only by having the lowest pH value in the collection (at that, still well above pH 6·0). No. 241, as already noticed, is extremely low in humus. With No. 233, it represents perhaps the most mature of these abortive red soils, halted in their development by being prematurely buried by fresh ash deposition (see para. (5), p.6).

As already noted in discussing the pumices, Samples 242 to 248 inclusive represent almost equally-weathered pumices, ashes or soils without striking variations. The pH's are all rather low, organic matter surprisingly and uniformly high for such ancient-looking materials—they are near the bottom of nearly 26 m. of pyroclastic sediments and weathering horizons. Their content of bases is also fairly high, perhaps because these were not eluviated quite as soon as formed, though there is no accumulation (see the pH's) such as must have occurred with this degree of weathering if precipitation had been at all deficient.

The remainder of the section consists of alternating ashes and soils, rather uniformly weathered, but not so much as the preceding group. The variations in organic matter follow no explicable pattern, though calcium and magnesium are consistently fractionally lower at the supposedly (visually determined) more weathered horizons (tempo-ary land-surfaces); higher where the ash looks fresher.

Mineralogical study

As already suggested, the mineralogy of pyroclastic volcanic sediments, all within the range andesite/basalt of intermediate to basic rocks, makes little difference to the soils developed on them by weathering. The mineralogy is, however, extremely valuable for characterizing and correlating pumices and ashes, and even for assigning them to particular vents and particular eruptions from those vents, if the vulcanology of the region is sufficiently well known. Though knowledge of Pleistocene vulcanology in Central Mexico is not yet so far advanced that we can identify pumices and ashes with any certainty—at least the older ones—mineral analysis was thought possibly to afford yet another useful approach to correlations between sites of deposits in similar stratigraphical positions.

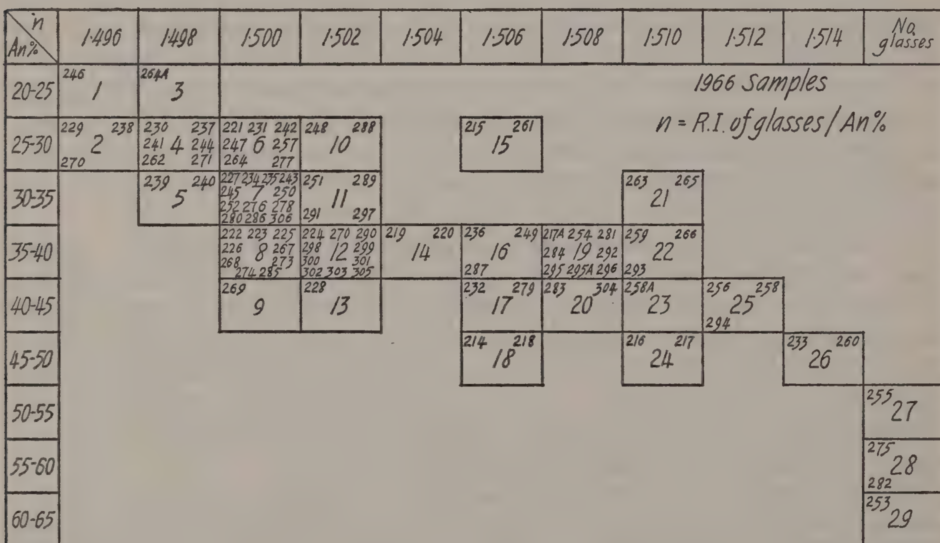

Fig. 4 Sotomayor's mineral plots

Though altered to some extent by weathering, study also of the mineralogy of the soils and their parent materials might be expected to throw some light on the sequence of volcanic sedimentation at a particular site, and so to fit vulcanological events into the general scheme of Pleistocene geological history which this study is designed to outline.

Sr. Ing. A. Sotomayor kindly examined and described the mineralogy of all the samples collected and, in particular, determined the position, in each, of the characteristic plagioclase felspars in the albite/anorthite scale (An %). He further examined the glassy portions of the materials and determined the refractive indices (n) of the most prominent glasses.

When these two quantities were plotted against each other, he obtained the distribution-diagram shown in Fig. 4. The number of the field in this diagram in which each sample falls has been added to the other results assembled in Figs. 2 and 3.

The An % property is regarded as the more reliable for characterizing a volcanic material and is to be given more weight in the case of any discrepancy. Thus, it is more likely to be significant, in identifying two samples with one another, that they fall in the diagram on the same horizontal line than that the verticals on which they lie are more or less widely separated. Obviously, adjacent fields are more closely related in their mineralogical properties; those horizontally-adjacent most of all.

In interpreting these data, all the theoretical considerations outlined in para (7), p. 8, must be borne in mind.

Referring to the samples in Fig. 2 (Sites A to E) and the distribution-diagram, Fig. 4, it appears that the first nine samples, representing the modern soil down to that on which Pumice η lies, all fall within the right-hand half of the diagram, in an area comprising five steps of An % and six of n.

The next seven samples, on the other hand, lie on the left side of the diagram, in a more compact area of 3 units vertically and 4 horizontally. It seems likely, therefore, that at least two distinct volcanic events, or groups of events, are concerned in the formation of these sediments, possibly to be associated with two different vents.

Three samples of Pumice η, however (Nos. 261, 238, 239), all in the same stratigraphical position, occur, one from Site B in the right (Field 15) and two from Site D in the left (Fields 2 and 5) portions of the diagram. Fields 2 and 5 are diagonally adjacent and Field 15 is on the same horizontal as 2, so that the samples might well represent the same event. If so, this event is stratigraphically intermediate between Sample No. 260, a weathered land surface (Field 26) and No. 219 (Field 14), a comparatively fresh ash, and looks as if it may be intrusive. It is possible, however, that No. 260 (Field 26), not closely related to anything else here, is the intruder, for No. 219 (Field 14) could as easily be associated with samples in Fields 2, 5, 6, 8, 12, in the left-hand group, as with the right-hand, where we at first put it.

Fields 23, 25, 22 (Pumice ε and the underlying soil, Samples 258, 258A, 259) form a compact mineralogical group and surely belong to a single event, unrelated to those giving rise to the immediately adjacent materials, which, stratigraphically below them, as above, lie in the left half of the diagram. Indeed, save for the intrusion of the Pumice ε group and the minerals of three samples (Nos. 232, 233 and 236, Fields 17, 26 and 16, respectively), the whole of the column down to the level of Pumice α/β (No. 249, Field 16) seems to fall within a small area in the left half of the diagram. The bottom four samples lie so clearly at the basic end of the diagram (Fields 19, 25, 27 and 29) as to be surely of different origins again.

Assignment of the pumices alone (Fig. 3) to their mineralogical Fields shows some gratifying correspondences, confirming their stratigraphical positions (e.g. β, γ, δ, θ, p.w.b.), but there are some mystifying and fairly consistent discrepancies between samples from Sites L and K and those (undoubtedly corresponding stratigraphically and in their gradings) from Sites B, D and E. No satisfactory explanation of these can, at present, be offered.

Obviously the interpretation of the mineralogical data is difficult (not to say hazardous) in the present embryonic state of our local knowledge of Pleistocene vulcanology and no more than the above broad generalizations can usefully be made. Ing. Sotomayor points out that at all times there can have been contamination from other sources of the materials sampled—by, for instance, wind-blown dust, slope-washing, disturbance by tree-roots and burrowing animals—so that the particular mineral grains determined by him may not all be original or typical of the sample. The samples were taken with due care, bearing such possibilities in mind, but nothing short of reduplicated sampling and multiplication of determinations can eliminate errors due to such chance intrusions.

Micromorphological soil-study

While the chemical, mineralogical and mechanical analyses were going forward in Mexico, the writer had thin sections prepared in England of all the soils, visually identified as such in the field.

It could be seen under a hand-lens in the field that some soils contained deposits, in root-holes and fissures, of iron-stained clay colloids, which may be recognized by their characteristic 'waxy' appearance on a freshly-broken surface of a dry hand-specimen. Indeed, the first three soils met with, at Site A, above the 'First Red Soil', were thus correctly determined on the spot as '?Parachernozem' (modern soil), '?Parabraunerde' and '?Braunlehm', respectively, without benefit of thin sections or polarizing microscope. Any attempt to employ this simple, but heroic, short-cut on samples from further down the section would have been doomed to result in misinterpretation, as will presently appear!

Samples considered in the field to consist of relatively unweathered pumices or ashes were not sectioned, unless they clearly represented parent-materials of a soil, which would be required for comparison with the upper horizons of a profile. The object of the study was to consider the micro-structures resulting from weathering, not the mineral constituents of the fabric. As a result, it was hoped that it would prove possible to recognize a particular soil in different exposures, for purposes of stratigraphical correlation, and perhaps to obtain some indications of the sort of environmental conditions under which the soils were formed, and hence of the course of climatic changes since their time.

Paragraphs (1) to (4) (pp. 5 and 6, above) detail the special theoretical considerations to be taken into account.

Some 30 thin sections were studied of the samples from the motorway, Sites A to E, including two from Site G and one, for comparison, from Sacromonte, near Amecameca, of unknown stratigraphical position relative to the former, but appearing to be of the same general character. Two comparative sections of samples of reddish soils from the Puebla area were similarly included, to see whether they corresponded with any from the motorway.

The remainder of the Puebla series, from Site X, Valsequillo, will be considered in connection with the other laboratory-results from samples at that site.

Descriptions of the individual sections follow:

DESCRIPTION OF SOIL THIN SECTIONS—MOTORWAY SITES

Site A

214 Grey-brown, with crumb-structure and plant-roots. Practically no colloids. Youthful, rounded, brown iron-concretions. Mineral grains fresh, with humus coatings. Plagioclase, augites, rare olivine. BRAUNERDE-PARACHERNOZEM

215 Brown subsoil. Redder brown than above, with plenty of colloids in and coating fissures and rootholes, but matrix mainly isotropic. Minerals with rounded outlines and signs of chemical attack. Olivine very rare. PARABRAUNERDE

216 Reddish with massive deposits of anisotropic colloids, now invading the matrix. Felspars dominant, little augite or hornblende. Hardly any olivine. Grains rounded and decaying. PARABRAUNERDE-BRAUNLEHM

217a Parent of above, at level of modern caliche, —2.75 m. Relatively fresh grey-brown ash. Colloids only locally infiltrated down fissures. Grains sharp. Ferro-magnesian minerals and olivine not uncommon.

217 'First Red Soil', upper. Masses of colloids—plasma fully anistropic, but still only in fissures. Mineral grains small: felspar, not much else. Pumices very decayed. Many voids. PARABRAUNERDE-BRAUNLEHM

218 'First Red Soil', lower. Mostly isotropic, but some colloids, chiefly in channels. Very fine ash. Glasses decayed. Colloids partly dehydrated.

Site D

226 Summit of 'Marker'. Distinctly red, but *no colloids*. Completely isotropic, apart from minerals. Dominant felspars, but some hornblende and even one olivine.

227 Upper part of 'Marker', below summit. Very red and dense. Disturbed and brecciated, with small masses of clayey soil, some with primary colloids, in a sandier, ashy matrix. Many strained and zoned felspars, hornblende, augite. Small rock- and pumice-grains, the latter largely decayed, though matrix-minerals are fresh. Both fines of matrix and the included clay pellets with original colloids almost *completely* isotropic, i.e. dehydrated. ROTLEHM, in part derived material—not pure ash.

228 Lower part of 'Marker'. In plane-polarized light looks like a Braunlehm, with masses of primary colloids, voids in the place of completely decayed minerals, sometimes containing remnant crystals. Most mineral grains small. Under crossed polars, the whole fabric is isotropic and dehydrated. Has a cracked and shrunken appearance. ROTLEHM ON BRAUNLEHM PRECURSOR

230 First soil below 'Marker', (M.2). Very similar to the above, but dense, with few voids. Even more colloids and minerals even more strikingly decayed. Matrix completely isotropic and though it may have originally been largely glassy, all the colloids are also isotropic. ROTLEHM

231 Middle of same. There are some larger felspars and pumices, mainly skeletonized. Otherwise as above. Colloids very prominent, but dehydrated.

232 Base of same. Plenty of smooth-walled irregular voids (?alveoli of completely-decayed pumice-grains). Most mineral- and rock-grains decayed and surrounded by a ferruginous aureole. The matrix completely isotropic. *In situ* colloids rare, dehydrated also.

233 Profile M.3. Very red. Widely-distributed shrunken colloids. Many empty alveoli. Minerals
=241 and lapilli rounded, decayed, surrounded by ferruginous aureole.

234 Third soil below 'Marker', M.4 (top). Formerly almost completely colloidal. Many voids. Minerals and lapilli mainly greatly corroded, but there are some strikingly fresh, rather large hornblendes (intrusive?).

235 Middle of same. Looks like a mature Braunlehm in plane-polarized light, but only ghosts of colloids left, otherwise completely isotropic. Deeply corroded minerals—some large olivines and augites loose in iron-ringed alveoli.

236 Ash with flecks of original colloids filling cracks and voids. Some minerals and lapilli leached and iron-ringed, but not deeply corroded. Matrix isotropic, probably glassy where not too deeply altered, but there are cracked and shrunken colloids also, which are almost completely isotropic—'ghosts' only showing faint residual anisotropy. Nevertheless, a few green hornblendes look quite fresh—?intrusive.

237 The matrix of the 'Older Lava' boulders. Fairly fresh minerals and lapilli, but plenty of colloids, now dehydrated, cracked and shrunken. Some are clearly *in situ*, but there is some disturbance, perhaps by slumping. ROTLEHM

263 *Sacromonte red soil*= ?'Marker'. Rotlehm, but with stronger 'ghosts' of primary colloids. ?Less mature. Many minerals are iron-ringed, but even some augites are relatively undecayed.

241 'Marker', M.3. Plenty of colloids, reduced to 'ghosts'. *Braunlehm precursor of Rotlehm.*
=233 Some empty mineral-alveoli and some iron-ringed, deeply-corroded grains.

243 Soil below Pumice (δ) *Rotlehm.* Some colloids originally present, but not prominent and now dehydrated. Isotropic (glassy) ash with andesite and pumice lapilli, deeply weathered *in situ*.

245 Soil below Pumice (γ). *Rotlehm*, but stronger 'ghosts' of plentiful colloids. (cf. Sacromonte).

248 Soil below Pumice (η). Plenty of interstitial colloids, but few voids and the minerals and lapilli are fairly sharp. Matrix, even colloids, isotropic.

250 Parent ash of 248. Brown, not red. No Colloids. Mineral grains sharp. Only slightly weathered.

251 ?Soil. No colloids, but brown-ringed lapilli. Most mineral grains are relatively fresh. If a soil, still rather immature.

252 Redder than above, but even less weathered.

253 ?Soil. No colloids, but bright yellow in colour, with many lacunae. Slightly weathered, mainly glassy, ash.

254 Ash, browner and less weathered than above.

257 Soil below Pumice (ε). Grey-brown with ?humus, but even the hornblendes are relatively
=259 fresh. There are slight concentrations of former colloids, now all isotropic.

259 Soil under Pumice (ε). Grey-brown, porous, but little other sign of weathering. Plenty of
=257 lacunae, but no colloids. Isotropic. Identical with 257.

260 Soil under Pumice (η). Superficially quite like the above, but *plenty* of anisotropic colloids under crossed polars. Felspars skeletonized. PARABRAUNERDE-BRAUNLEHM

Whatever the conclusions in detail to be drawn from the individual specimens, some general facts of the greatest importance emerge from the visual examination of these thin sections.

(1) The modern soil is unique in the series. Clearly the factors of parent-material and exposure are the same for a modern, as for an ancient, soil in this situation. The qualitative differences must, therefore, be due to climate, the biological factor or time. Mere immaturity (time) may also be ruled out, for one cannot conceive of a sub-arid soil-type like parachernozem developing into a braunlehm or rotlehm in *any* length of time, without considerable increase in precipitation, or at least its more even distribution throughout the year.

It must be evident, therefore, that the ancient reddish soils with colloids connote a climate much moister than the present, or at least one with a much less intense and prolonged dry season. With the increase in moisture must have gone a considerable enrichment of the flora—a forest, or at least forest-savannah plant-community being suggested.

(2) Another point of great interest is that the series of soils above the 'Marker' all contain fresh colloids, save that below Pumice ε (Samples 259, 257), which is of Braunerde character, containing humus and having a fair crumb-structure, but in which the iron-compounds are all flocculated and immobile. The ontological stages of soil-development here are probably: Eutrophic braunerde—Parabraunerde—Braunlehm (climax), with all intermediate gradations. The soil in question is probably only very immature.

(3) The 'Marker' *and all soils below it*, right down to the matrix between the tops of the 'Older Lava' boulders at the base, once had Braunlehm colloids, but these no longer appear anisotropic under crossed polars*. They are more or less completely dehydrated, showing shrinkage-cracks, their contained iron having been converted from limonite to goethite, or even haematite.

When this phenomenon was first observed, it was suspected that there might be some degree of desilicification also—a beginning of the process which, in the hot/humid tropics, culminates in the formation of laterite. Determination of silica in four samples from the 'Marker' (M. 1), the most mature profile available and so the most likely to exhibit this feature if it were present, showed no significant eluviation of silica:

			$SiO_2\%$
226 'Marker' (M. 1), summit			49·82
227 ,,	,,	25 cm. below summit	49·92
228 ,,	,,	75 cm. ,, ,,	47·14
229 Relatively unweathered ash, parent of M. 1			45·83

The summit of this profile, represented by No. 226, is notably sandy and friable in consistency and has evidently lost some colloids by physical down-washing, as is suggested by its mechanical analysis. This would account for the *increased* silica-percentage in the upper two samples as compared with the parent-

* This is why the hand-lens, without polarizer and analyzer, would have been misleading. The appearance of the colloids under crossed polars is necessary to demonstrate their practically isotropic nature.

material. There is clearly no significant *decrease*, the 0·1 % difference between the first two figures being probably within the margin of experimental error.

The 'Marker', therefore, has not yet reached the state of a Roterde, which is, by Kubiena's definition, characterized by incipient desilicification, passing, via Allitic Roterde, with a lowered SiO_2/Al_2O_3 ratio, into Laterite, which may be completely desilicified—a ferruginous bauxite.

The immobilization and dehydration of the iron-colloids observed here, however, marks a transition from Braunlehm to Rotlehm. Such dehydration cannot take place under a forest cover with perennial moisture. It necessitates a pronounced dry season (with plentiful precipitation at other times), during which the vegetation-cover is leafless, if forest, or, if mainly grasses, dried out, so that the sun can reach the soil directly and by heating it dehydrate colloids formed during the last wet season. This suggests a savannah, rather than a forest type of vegetation.

(4) Not only must the climate have been moister than today and the vegetation richer during the formation of the red soils above the 'Marker', but there is a striking environmental difference apparent between those above and those below; in one series ('Upper Red-Soil' Series) fresh colloids, in the other ('Lower Red-Soil' Series) evidence of the former presence of colloids, now eluviated (No. 226) or dehydrated *in situ* (227).

In addition to this environmental conclusion, the presence or absence of fresh colloids in a soil of unknown age or stratigraphical position should enable it to be assigned with some confidence to one or other of the above two Series (in this particular area)—always bearing in mind the possibility of local differences in contemporary soil-forming factors.

As one instance: the red soil from Sacromonte (No. 263) proved to have only 'ghosts' (partially dehydrated relics of colloids), which, though stronger than those of the M. 1 profile, nevertheless suggest that this soil belongs rather to the 'Lower' than the 'Upper Red-Soil' Series.

Conversely, a sample (no Lab. No.) of the Red Bed immediately above the lava, at the base of the Cerro de Loreto, Puebla (Site W) section, proved to be a well-developed Braunlehm with fresh colloids, and is therefore to be correlated with the Upper Series of the motorway.

Again, a sample of the basal red soil (Bed 4) (no Lab. No.) of the Site X, Valsequillo, gully-section, also contained plentiful hydrated colloids, and so almost certainly corresponds with the foregoing sample.

It may be objected that the last two samples are far away from the deposits in the motorway sections with which they are being compared. Emphasis is put on the fact that we have here some qualitatively typical reddish soils, quite unlike any today in process of formation in the region. Those in the motorway exposures provide a complete history (almost without evidence of denudation, and that only local) of the more recent volcanic and soil-forming events in the

region. The latter, *mutatis mutandis*, may reasonably be supposed to have influenced the whole region equally. It is therefore highly probable that red soils *anywhere* in the region are due to one or other of the different climatic phases to which the two Series recognized in the motorway are attributed. The intrinsic character of the colloids in the two samples in question leaves little room for doubt as to to which of these Series they should be assigned.

(5) Granted so much, an interesting consequence results. Since both the Cerro de Loreto and the Valsequillo samples clearly belong to the 'Upper Red-Soil' Series, and since these old land-surfaces both underlie a thick and complex succession of deposits corresponding to a long sequence of local sedimentary and weathering events, it follows that all this succession at both sites must be subsequent in date to the formation of the 'First Red Soil', which is the clearest evidence in the motorway sections of the particular climatic phase to which we have attributed the two red-soil samples concerned. This conclusion is not at variance with any other which can so far be arrived at from examination of the stratigraphy at, and investigation of samples from, those sites (see below, p. 31 ff).

Evidences of erosion, and conclusions therefrom

Before leaving the motorway sections to consider the experimental results from the Puebla sections, at the far end of our transect, it is necessary briefly to examine the few evidences of erosion and denudation shown along the motorway.

As has been mentioned already, in passing, the long sequence of volcanic sedimentation and weathering seems seldom to have suffered any interruption by the kind of widespread denudation which is taking place at the present day. In view of the character of the fairly rich and complete vegetation-cover which has been inferred from the type of soil found, this was probably due to the protection which it afforded to the contemporary soil by breaking the erosive force of heavy rain and by holding the soil together with a close root-mat.

At Site B, there is a bed, little more than 50 cm. thick, immediately below Pumice ε, which shows a certain stratification and contains a quantity of stones. This deposit is clearly due to slope-washing of ashes and various other surface materials by water and has eroded and ravined the layer of ash *in situ*, which, of course, is unstratified and quite stoneless. About 40 cm. of the ash survives, covering the 'Marker'-surface. By itself, this looks like quite a minor erosive interlude.

At Site E, only 3 km. further on, there is a very striking disconformity, falling between the Lower and Upper Red-Soil Series. The M. 1 'Marker'-soil profile is cut away on the northern flank of the spur through which the motorway-cutting passes, and this erosion extended right down through the greater part of the sedimentary layers on which the several members of the Lower

Series of soils had been developed. The volcanic sediments of the Upper Series were then deposited unconformably on this eroded slope and terminated with the formation over all of the well-developed 'First Red Soil'. It is possible that the evidence at Site B was the locally rather slight expression of the same erosive phase, though, here, not actually having cut into the 'Marker', but only partly through its immediately overlying bed of ash.

A little beyond Río Frío, at Site K and other sections nearby, there is a similar, but even bigger, erosional disconformity exposed along nearly 500 m. of the roadway. This cut through the whole of the 'Lower Red-Soil' Series down to the level of Pumice β. On this irregular, ravined, surface were laid down lenses, some 10 m. in length and up to 1.5 m. thick, of slope-derived coarse andesite gravels. Above these followed ashes and on them some red soils of the Upper Series, not very clearly exposed just here, and, over all, deposits of the Río Frío Series topped by the modern brown humic forest soil. Involving, as it does, almost the whole of the 'Lower Red-Soil' Series and evidently preceding the Upper, this erosion seems to correspond in time with that described at Site E.

The coarse gravelly lenses, extending over a wide area and developed in several stages to a considerable thickness, are interesting because their lack of either stratification or manifest water-sorting immediately strikes the eye of a north-west European Pleistocene field-worker as being due to solifluction.

Even at only 19°20′ north of the Equator, this explanation is not as nonsensical as it may first appear, for the place is situated at an altitude between 2,800 and 2,900 m., while glacial studies on Iztaccíhuatl[9] have shown that the maximum Upper Pleistocene glacial advance (Nexcoalango deposits, equated with early Wisconsin) extended in places down to 2,750 m. Even if not actually glaciated, Río Frío and its immediate environs must have been well within the periglacial area of more than one glacial advance in the Sierra.

The same author[10] refers to 'sediments similar to glacial deposits (within the most ancient alluvial deposits)' and attributes them to a pre-Wisconsin phase. On the western flank of Izta. he has observed these down as far as the 2,450–m. level. By 'most ancient alluvial deposits' he clearly means, at least in part, what are here described as the 'Upper' and 'Lower Red-Soil' Series: indeed, in Plate 3, p. 18, of the work referred to there is an immediately-recognizable picture of the road-cutting '11 km. north of Tlalmanalco' which is here called 'Site E'. This photograph displays the Older Lava at the base, the 'Marker'-series of soils overlying it, some 5 m. of relatively unweathered ash and pumice, with the 'First Red Soil' above. The view does not extend far enough to the left to include the striking erosion-surface and unconformity

[9] White, S. E., 'El Iztaccíhuatl', *Serie Investigaciones* **6** *INAH* (May, 1962), 39.
[10] *ibid.*

described above, but there seems no reason to dissent from its assignment to a pre-Wisconsin date—even, possibly, one *long* pre-Wisconsin.

Though there is no direct evidence of the identity of this erosion with that observed at Site K, with its immediately-sequent solifluction-lenses, it would seem sensible to attribute both to similar, if not identical environmental events, disturbing the regular alternating sedimentation/weathering processes which produced the materials described in all the sections. This interfering climatic event (or events) would be a local glacial advance to comparatively low levels on the flanks of the Sierra and consequent destruction, or serious local thinning, of vegetation-cover. The ashes and soils would then be exposed, at least locally, to intense erosion, followed by deposition in some cases of solifluction-fans, where the topography and exposure favoured it. It is worth noting, in this last connection, that both the eroded slopes referred to at Sites E and K have a northern exposure, which, under the given conditions, would greatly favour the alternate freeze-and-thaw which causes solifluction.

The two Red-Soil Series thus seem to be separated by a period of erosion, and perhaps local solifluction, associated with the advance of a local glaciation. This seems most likely to be the Tonicoxco phase, named by Sidney White, for no other, later, glacial advance reached such low levels[11], while in these latitudes, the fringe-area of periglacial temperatures beyond the actual ice-front can never have extended downwards over more than a few hundred metres.

Now, José-Luis Lorenzo[12] has very reasonably adopted, for Mexican glaciations, the theory of E. A. Bernard[13], designed to explain the mechanisms governing tropical pluvial periods in Africa. Since glacial advance in high mountains in latitudes as low as 20° N depends not only on the low temperatures due to altitude but also plentiful precipitation, Lorenzo concludes that the glaciers in the high Sierra could only have advanced to lower altitudes during an *isopluvial* (Bernard), with adequate precipitation all the year round. The winters in Mexico at the present day are characterized by almost uninterrupted drought (*displuvial* conditions) and, though temperatures at altitude may be sufficiently low to favour snow-accumulation and glacial advance, the absence of heavy snowfall, save during the warm summer season with its rapid melting conditions, makes this impossible. Bernard's *iso*pluvials coincide with interglacials in the north temperate zone, *dis*pluvials to northern glaciations, so that glacial/interglacial alternations in the tropics must be, in time, the reciprocals of those in the temperate zone, if the theory is right. Thus the displuvial conditions in Mexico today suggest that we are not yet quite out of the Ice Age!

11 *ibid.* p. 39.

12 Lorenzo, J. -L., *La etapa lítica en México*, INAH (1968).

13 Bernard, E. A., 'Théorie astronomique des pluviaux et interpluviaux du Quaternaire africain', *Mens. Acad. Roy. Scs. Outre Mer. Class. Scs. Nats et Meds.* 12(1) (1962), 1–282.

The types of red soils described unquestionably mark periods of all-the-year-round humidity, at any rate in their inception, as Braunlehms, and, though the Lower Series, with their dehydrated colloids, suggest some degree of seasonal drought, this can never have approached the present-day (displuvial) conditions, for we find no trace, in the observed succession, of soils comparable with the parachernozems and immature brownearths which clearly correspond with those conditions today. A mere interstadial, with only sub-displuvial conditions, is perhaps indicated.

Into this moist/relatively dry/moist succession, then, following the drier phase, is intruded, at Sites E and K, evidence of glacial advance, possibly, as suggested above, of the Tonicoxco glaciation. On the face of the evidence, therefore, this would seem most likely to correspond to the second advance-phase of that main glacial event. The date ascribed to this in Lorenzo's tentative correlation-diagram (adapted from White[14]), though undefined, falls before 45,000 years B.P., which is not inconsistent with the 30,000+ B.P. date for the Río Frío *nuée* which, with the 'Younger Lava' locally intervening, overlies the Upper Red-Soil Series. The latter, less fully developed than the Lower, would correspond with the retreat-phase of Tonicoxco II, with precipitation still high, but temperatures gradually rising to prevent any further ice-accumulation. It may be significant, in this connection, that the uppermost phases of the 'First Red Soil' formation at the higher sites (Sites L and M) are somewhat atypical, weakly developed Parabraunerdes, tending rather to Braunerde proper than to the typical Braunlehm which is seen in the type-exposures about 800 m. lower in altitude.

In theory there should be a *catena* of soil-types as we rise along the motorway from the lake-basin of Chalco to the higher parts of the pass, near Río Frío, due to falling average temperatures and increasing orogenic precipitation with increase in height.

This is, in fact, the case with the modern soils. Parachernozem with a well-marked Ca-horizon prevails in the lower foothills, between about 2,250 and 2,500 metres. At about the present lower margin of pine-forest (2,650–2,700 m.) the carbonate concretions are no more seen and the soil becomes a brown or yellow eutrophic Braunerde without marked horizons. At the summit of the pass, 3,159 m., the present soils are dark, moist brownearths with some mull-humus accumulation, which bespeak low average temperatures and adequately distributed rainfall. The parent material being basaltic lava or ashes with plentiful base-rich minerals, there is a constant supply of bases by gradual weathering of these, so that, even under the cool/moist conditions prevailing, there is no question of development of low pH or of leaching of iron, which would lead to a more podsolic type of soil.

[14] White, S. E. *op. cit.* fn. 9.

It is a fact, however, that the expected difference in appearance between the reddish soils at Site L (2,850 m.), for instance, and the type-series at Sites A to E (2,400–2,600 m.) is not striking. The 'Marker', for instance, appears to be identical at both sites, even under the microscope, though there are some micromorphological differences in the 'First Red Soil' series. One can only suppose that, under isopluvial conditions, the marked differences in precipitation which evidently control the modern catena were eliminated, or at least reduced, and that those of temperature due to the differences in altitude were not critical. The postulated vegetation-cover would have tended to moderate the micro-climates also. This question is further treated below, under the discussion of the comparative soil-samples collected in 1968.

Puebla sites

The principal sites studied at the eastern end of the transect are near the City of Puebla, in the valley of the R. Atoyac and that of its tributary, the Alceseca.

Site W is an area of modern gully-erosion on the north flank of the Cerro de Loreto, about 3 km. north of the City-centre.

Site X is another series of gullies close to the north shore of the modern (1943) Valsequillo Reservoir, alongside the road from Totimehuacán to San Baltazar Tetela. The latter village is situated on a narrow spur, now forming a peninsula in the reservoir, and the archaeological site of Hueyatlaco (Site Y) is on the eastern shore of the peninsula, close to the maximum water-level of the reservoir.

The deposits at all of these sites, though not identical, bear a strong family resemblance to one another and are completely different in character from those in the westerly and more mountainous parts of the motorway, though they share some features with the much shallower sections explored towards its eastern end (Sites Q, R, S, T, U). One reason for the difference referred to is that, while the western motorway sites were fairly close to the volcanic vents (whichever they were) from which most of the ashes and pumices emanated, the Puebla sites are far from any large volcano, save La Malinche, and any pyroclastic materials emitted by those had to travel further through the air to reach the Puebla area and had many of their coarser components sorted out in the process.

The materials consist of more or less alternating deposits of very fine weathered volcanic ashes with intervening harder beds, some of which appear to be soils. The differences between the looser and the more consolidated beds seem to be mainly of consolidation and cementing, if not always very marked chemical weathering. The latter are more resistant to modern mechanical erosion and stand out as more or less sharply defined 'steps' in the gully sections. The uppermost two such hard beds are specially well marked, because they

weather into almost vertical, sharp-edged cliffs, and these protect some of the underlying deposits from rain-washing and so on, making many of the exposures very steep. The stratification of all is conformable to the underlying slope of the land, and there can be no question, from this fact and from their heights above the present (artificial) local base-level (2,059 m. and below) provided by the reservoir, that they are anything, in the main, but redistributed air-fall ashes and pumices, all more or less weathered throughout their thickness. That there was, indeed, at one time, a natural lake in the Valsequillo basin there can be no doubt. It seems to have been temporarily formed by a lava-flow from the Cerro Colorado (or Toluquillo) which blocked the Atoyac valley some 4 km. to the west of the present concrete dam, but it can never have had a maximum extent much greater than that of the present reservoir and there can be no question of its ever having extended laterally to, or up to the level of, Site W, between 2,230 and 2,240 m.—at least within the Late Pleistocene times with which this study is concerned.

There are, however, undoubted gentle stream- and shallow-water (playa?) deposits near the present lake-level and it was in one of these, at Site Y, that remains of extinct animals were found, in association with humanly-fashioned stone implements, by Cynthia Irwin-Williams in 1964 and 1966.

Site X. Laboratory results from samples

The Site X deposits were sampled throughout during the 1966 season and the same series of physical and chemical tests was applied to them as to the Sites A–E samples. The results are presented in the diagrams, Figs. 5 and 6. Thin sections, as before, were prepared and studied in England. Ing. Sotomayor's mineralogical study (above, and Fig. 4) included all these samples also.

At the time when the samples were taken, it was supposed, on geomorphological grounds, that the gullies evidenced two phases of sedimentation and downcutting, for there are two distinct terminal surfaces apparent: (1) that of the general hill-side before the first cutting of the gullies and (2) that of various spurs and outliers of stratified sediments within the main gully, terminating at a very constant lower level, of which the tops are now often grass-covered and have some degree of modern soil-development on them. The latter apparently pointed to an intervening phase of erosional standstill, or even of re-sedimentation. An effort to prove the existence of an erosional disconformity between the latter formations and the wall of the gully, by means of a trench cut in 1966, failed to demonstrate any such thing as re-sedimentation. The geomorphological features, however, do still suggest two periods of downcutting, separated by one during which the gullying process came to a halt and the existing surface at the bottom of the gully became stabilized by some growth of vegetation. This may correspond with a moister period, which, in conformity with Bernard's theory, should be an isopluvial incident, accompanied by advancing glaciers in the high mountains.

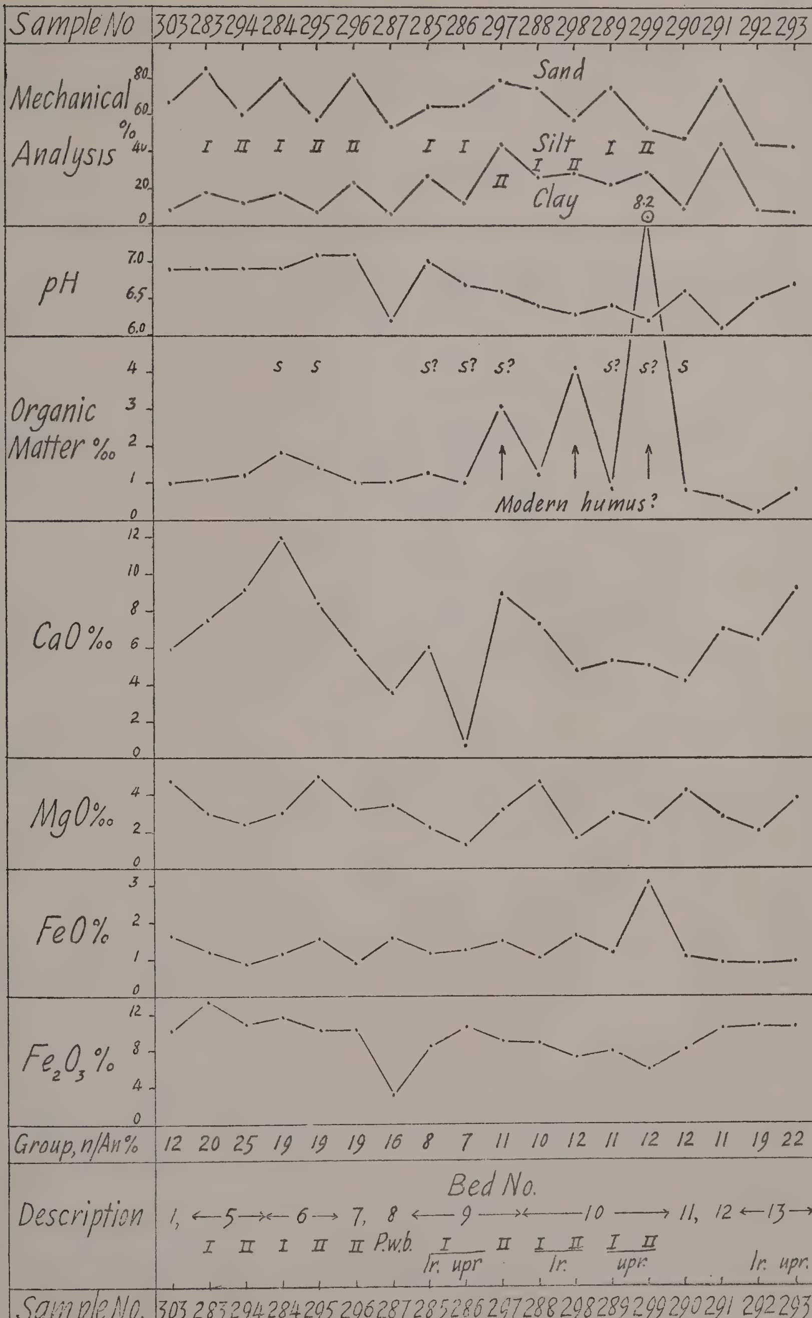

Fig. 5 Valsequillo, lab results

Returning to the samples: the result of the first theory, however mistaken, was that several samples were duplicated; one set taken from the walls of the gully and the other from the dissected 'terrace'-remnants within it. Both were studied by the laboratories on their intrinsic merits. Some differences emerged, which are discussed below.

The sequence began with a short section in the bank of the reservoir, which displayed 2 m. or so of fine, apparently unstratified vertically-fissured silty sediment (Bed 1), rising from the water-level, the base of which was not seen. On it lay a well-stratified hardened coarse-sandy pumice, locally called *xalnene* (Bed 2), which emanated from the Cerro Colorado (or Toluquillo), a small vent 3 km. to the east of the site, which in earlier times was also responsible for the natural lava-dam which formed the ancient lake.

The *xalnene* is covered, in its turn, by a thick (3 m.) bed (Bed 3) of pale yellowish-brown sandy ash, now compacted and hardened, the upper part of which is weathered to a striking dark red-brown layer (Bed 4), which has already been mentioned above as having a well-marked Braunlehm-soil micromorphological character, with plentiful fresh colloids. By some oversight, these beds were not sampled at the waterside, their only vertical exposure, for the chemical, physical and mineralogical tests. Fortunately they appear to lie considerably below the archaeological horizon at Site Y, so that their omission is not crucial. One sample, No. 303, from directly beneath the *xalnene*, some distance up-hill, was taken later because it was thought perhaps to represent a subaerially weathered soil. Its properties, as shown in Fig. 5, do not suggest an appreciable degree of weathering, so that it probably represents Bed 1 adequately. It is a somewhat sandy silt with only a low proportion of clay. In comparison with some undoubted soils in this series, it is clearly not a soil, but probably an air-fall ashy pumice only slightly weathered.

The rest of the samples in the diagram are in their stratigraphical sequence, from below upwards. Some, as already noted, are duplicated and the duplicates are placed together for ready comparison, marked 'I' and 'II'. Those at first thought to belong to a second alluviation (II) show a family likeness with their respective duplicates (I), but are almost invariably more sandy, as may be seen from the detailed particle-size analyses (Fig. 6). This is evidently a fairly consistent phenomenon, and is not, therefore, likely to be due to mere chance or simple contamination. Its explanation is at present uncertain, but may only be due to some lateral rearrangement of the materials, shortly after their original fall, by wind-erosion on the slope. This would tend to remove silt particles from the surface layers and so result in some enrichment in the coarser sand-grades.

In three cases (Nos. 297, 298 and 299—all of Series II) the samples contain exceptional amounts of humus. These were, in fact, collected from only a short distance below the modern surface of an outlier and may well have

acquired their humus from the modern, grey-black para-chernozem soil, which is richly humic.

The systematic differences referred to cannot by any means be due to redeposition in a second alluviation. In that case, all deposits would have been mixed together and have lost any resemblances to their opposite Nos. I. That such is not the case, is made clear by their marked resemblances in respect of features other than their grading, as, for instance, their mineralogical properties (see below).

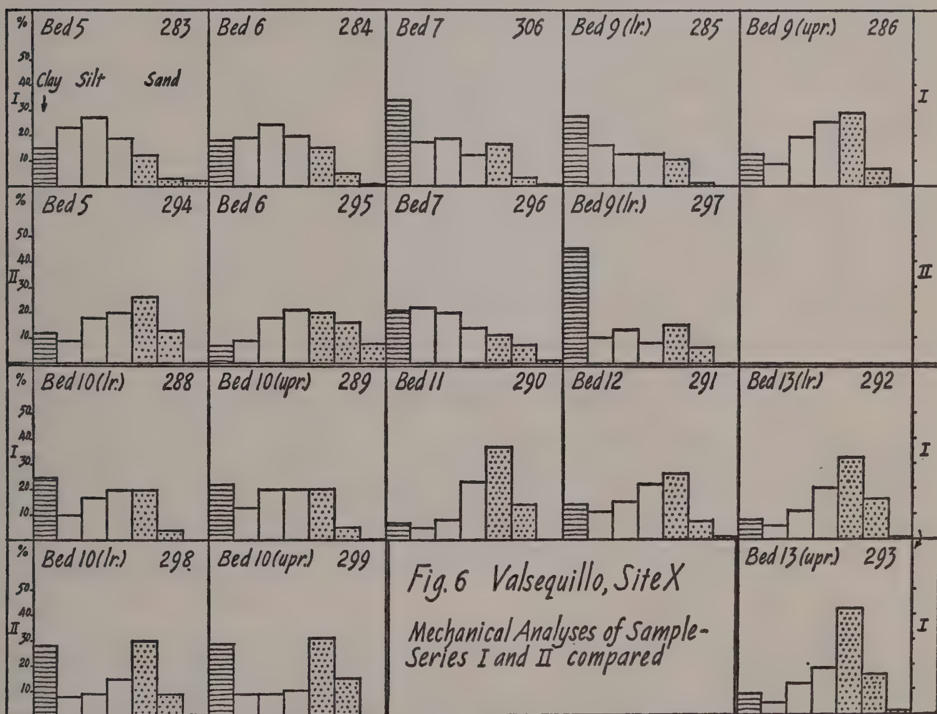

Fig. 6 Mechanical analyses of I and II samples, Valsequillo

The pH values are not, on the whole, very informative. All are close to neutrality, the most consistent block being Nos. 283, 294, 284, 295 and 296, all very close to pH 7.0. It may be significant that these also have higher contents of available bases.

Organic matter is present in small amount, close to 1%, in nearly all. Those samples thought to represent soils are marked 's' in this compartment. As already noted, the only major peaks of humus content are surely secondary.

The mechanical analyses show some anomalies between supposedly matching pairs of samples. Four stand out as fresh air-fall pumices or ashes—Nos. 287 (the fine pumice-with-biotite sealing the stream-channel fill), 290, 292 and 293 (the last two representing the hard sandy beds at the summit of the section). Some others (Nos. 296, 285, 297, 288, 289, 299) are distinctly clayey and this feature, alone, suggests some considerable degree of weathering perhaps *in situ*.

High clay-content, on the whole, but not invariably, is correlated with a high content of acid-extractable bases. The lower values, here, generally belong to the fresher, sandier sediments, as might be expected. The particularly low values for No. 286, on the other hand, suggest that this is *not* a soil, as had been supposed at first sight in the field, though its pair, No. 297, would appear to be so. Since this is one of the samples with abnormal humus, however, the weathering-evidence is possibly also secondary.

Relative contents of ferrous and ferric oxides do not, on the whole, distinguish clearly between weathered and unweathered horizons. Only No. 287, the very fresh pumice-with-biotite is markedly low in ferric oxide. No. 299, the modern soil developed on Bed 10 material, has only a moderate amount of Fe_2O_3, but about 3 times the average content of FeO. Judging by the amount of clay present, this should be a fairly mature soil and the reason for its apparent reduction is not clear. No question of impeded drainage could arise on this sloping site—and in the middle of the dry season!

It emerges that the best-characterized of the supposed soils is that of Bed 6, Nos. 284, 295. The top of Bed 9 does not seem to be much weathered, to judge from the one trustworthy sample, No. 286. Its pair, No. 297, is clearly contaminated. Nos. 289, 299, from the top of Bed 10, are not very convincing as soils, nor is the upper sandy *café-au-lait* bed, Nos. 292, 293. No. 291, Bed 12, on the other hand, not collected as being a soil, probably is so, though immature.

Mineralogy of the Site X samples

In Fig. 5, the numbers of Ing. Sotomayor's mineral groups, taken from Fig. 4, are entered alongside the physical and chemical results. One thing stands out clearly: whatever the present chemical state of the samples, they almost all fall into two distinct mineralogical groups, on the showing of their contained plagioclases and glasses. The upper hard sandy bed (Nos. 292, 293) belongs, mineralogically, with Nos. 283, 294, 284, 295 and 296, all members of the lower, sandy-ash, series, and is basaltic in character. The rest, with one exception, form another compact group, slightly more acid, i.e. andesitic. No. 287, the fresh pumice-with-biotite, lies fairly in between these two groups, in Field 16.

Thin sections, Site X, Tetela Road gullies, Valsequillo

Sample No. 303 comes from the third gully, up the road from the main site, where the *xalnene* thins out in a feather-edge on the underlying limestone-conglomerate. It represents the top of Bed 1, immediately beneath the *xalnene*, and was thought, here, to be subaerially weathered and to represent a soil.

The material is a fine, silty, volcanic ash, with very few phenocrysts and those almost exclusively felspars. Some colloids are to be seen, thinly coating the surfaces of fissures and voids, but not invading the fabric. These do show some degree of subaerial weathering, but, if a soil, it is an extremely immature one.

Basal red bed, Bed 4. (No lab. no., does not appear in Fig. 5)

The material is not truly red in thin section, but foxy-brown; dense and cracked, with some prominent dark lapilli, much weathered at the edges. A few green, or greenish-brown hornblendes show pleochroism. Several lapilli enclose fresh olivines. Under crossed polars, minerals are, on the whole, small and angular, mainly plagioclases, but there are occasional pyroxenes. Anisotropic colloids surround the lapilli and coat the surfaces of all cracks and voids, without much invasion of the fabric. Most of the iron in the fabric is, in fact, flocculated and there are occasional young (rounded) limonite concretions. *Parabraunerde tending towards Braunlehm.*

Two other red-soil samples from the Puebla region, taken for comparison with the above, are here introduced.

Fuerte de Loreto, Puebla. Red bed lying on lava, at the base of the barranca section (No lab. no.). In thin section the sample is bright yellow-brown in colour, not red. It is dense and fissured. The mineral crystals are more numerous, and coarser than in the Site X, Bed 4, sample. Several large lapilli are present. Pyroxenes and hornblendes are both frequent. The many cracks, fissures and larger voids are filled with rather pale (not strongly ferruginous) anisotropic colloids, which do not, however, largely invade the fabric. There are many small limonite concretions. *Initial Braunlehm, developing from Parabraunerde.*

This sample clearly belongs to an environment like that which produced the former—warm-temperate and moist through most of the year, completely different from the present sub-aerial conditions, which are represented at both sites by modern Parachernozems.

Site U.2, basal red bed in barranca. (No. 301)

The sample is browner than the above, more crumbly and with large voids. Colloids are dispersed in the fabric, but not all are *in situ*; under crossed polars these almost disappear, only faint 'ghosts' being still to be seen. Clearly they are altered by dehydration so that they are no longer anisotropic. *Rotlehm formed on an immature, and possibly somewhat disturbed, Braunlehm.* (cf. No. 56, p. 43).

The dehydration marks this sample clearly off from the former two. The appearance of 'ghosts' of former colloids is remarkably like that of the 'Marker' Series in the motorway samples, and it probably, therefore, belongs to the 'Lower Red-Soil' Series, while the former two Puebla samples, as clearly belong to the Upper.

No. 283

Pinkish clay, Bed 5, over red bed. The sample is pale yellow-brown in thin-section with biggish smooth-walled voids, cracks and channels. There are a few brown concretions and precipitates of limonite. Mineral crystals are mainly in the fine-sand grade and there are a few small lapilli. The matrix is clayey. The few coarser grains are mainly felspars. Pale colloids thinly coat the walls of most of the voids, but some are nearly blocked with larger masses. Colloids invade the matrix locally. *Immature, but distinct, Braunlehm, on very fine ash.*

No. 294, duplicate of the above

Large limonitized lapilli are prominent. Pale colloids are plentiful, in the matrix as well as in the fissures. Felspars provide most of the surviving mineral grains. There are next to no ferro-magnesian minerals. *Braunlehm, fairly mature.*

No. 284. Harder cap at summit of Bed 5. Bed 6.

The matrix is the same as in No. 283, but the fabric is somewhat denser. Ferruginous precipitates are larger and more prominent. The colloid linings of the larger voids are thicker than in 283, but there is only a small amount of spreading of the colloids into the matrix, perhaps because of its density. Felspars survive, but Fe/Mg minerals are scarce. Many holes in the fabric seem to be the alveoli of now-decayed crystals or lapilli. Not less mature, but different from 283: *Parabraunerde to Braunerde*, possibly indicating drier conditions than in the former?

No. 295. Duplicate of 284, Bed 6.

The section, though of the standard thickness, shows rather dark under crossed polars. There are as many empty alveoli as surviving crystals—very little other than plagioclases. There are thin colloids in fissures, but limonite precipitates are prominent. *More Braunerde than Parabraunerde, but not immature.*

No. 296. Grey clay, Bed 7.

Not sampled in Series I. This is from II. Fine grained ash. A few felspars are the only coarser grains. Lapilli are limonitized. The finer fabric is permeated with colloids, visible only under higher power. *Braunlehm, characteristic, but still somewhat immature.* The amount of peptized material in the finest interstices and the clayey matrix show why this material breaks up spontaneously into crumbs on drying.

No. 306. Grey clay, Bed 7.

Sample taken for another purpose, serves for comparison with No. 296. Plenty of colloidal material in the fine matrix, but no visible flow-structures. There are very few Fe/Mg minerals surviving and many empty alveoli. *Braunlehm, fairly mature.*

No. 285. Bed 9, lower part of second hard cap. (?soil formed on Bed 7)

Porous, mainly fine ash. Clayey matrix with plagioclases but few Fe/Mg minerals. Many empty alveoli of decayed crystals. Voids only locally thinly lined with colloids. Weathered, but not with production of voluminous colloids—or, if once so, these have been lost by washing through. Not a soil?

No. 286. Bed 9, upper part. ? soil.

The section is predominantly grey and looks much like the above, but the colloids are more widespread and plentiful, though only in voids, not in the fine fabric. There are a few hornblendes, where locally protected by their dense surroundings from being involved in weathering processes. *Very immature Parabraunerde*, if a soil at all.

No. 297. Duplicate from II of above.

There are plentiful lapilli, fairly fresh in appearance. Colloids appear in all holes and even in the fabric. There are some protected Fe/Mg minerals—even olivines—in the fabric. Few large crystals, even the felspars are small. *Immature Braunlehm.*

No. 288, Bed 10, forming a talus below the lower café-au-lait hard shelf.

The sample is of a much fissured dense, fine ash with colloids only in the main conducting channels. There are plenty of Fe/Mg minerals where they are protected by their surroundings. The larger crystals are mostly plagioclases. *Relatively unweathered ash, in situ.*

No. 298, Bed 10, parent of modern soil at summit of outlier II.

There are plenty of weathered glassy pumice lapilli. Mineral grains are of the medium-sand grade, locally somewhat oriented and sorted—a sign of slope-washing by water. There are some colloids both in lapilli and in the finer fabric, but no flow-structures. *Immature Braunlehm*, now involved in modern erosional and soil-forming processes.

No. 289, Bed 10, summit. ?soil.

The sample is denser and less fissured than 288, with lapilli more deeply weathered. Limonite precipitates and many empty alveoli. There are thin coatings of colloids in a few fissures. More weathered than 288, but still immature as a soil.

No. 299, Bed 10, summit, part of modern soil on outlier II.

The sample is dark with humus and has a distinct crumb-structure, loose and porous, very different from 289, its duplicate in stratigraphical position. Evidently much altered by modern soil-forming processes.

No. 290, Bed 11, middle part of lower café hard step.

Fabric dense, but with many empty alveoli. Colloids line most of these thinly and to some extent invade the adjacent fabric. A few weathered lapilli and some ferro-magnesian minerals. *B/C-horizon,* if part of a soil at all.

No. 291, Bed 12, forming talus between the two hard café steps.

Much fissured dense ash with brown lapilli. There are plenty of undecayed ferro-magnesian minerals but also many empty alveoli. Thin colloids line the larger fissures and some are in the fabric itself. *Incipient Braunlehm.*

No. 292, Bed 13, lower part. Upper hard café.

Sandy ash with plentiful lapilli, many decayed. Colloids line almost every hole and fissure, but thinly, though the fabric is permeated with them. *Braunlehm, B/C horizon.*

No. 293, Bed 13, upper part of second hard café.

Sample is distinctly pink in the hand and in thin section. Porous, weathered coarse-sandy ash with masses of colloids in all fissures, invading the surrounding fabric. Fe/Mg minerals rare. Lapilli limonitized. *Well developed Braunlehm.*

All the samples show distinct signs of weathering (compare the amounts of Fe_2O_3 in the chemical analyses), generally in the form of decayed lapilli and empty alveoli of former crystals, with modest amounts of clay/iron colloids in some. Even Bed 6 (284, 295) is not very clearly a soil, though in the field it forms a distinct step, resistant to modern erosion. No. 292, on the other hand, is a distinct braunlehm, while its lower fellow, no less hard and resistant, shows little alteration by weathering. There is no caliche in any layer, save some veins near the surface evidently infiltrated from the modern soil.

Conclusions

All the materials examined seem to be more or less weathered fine ashes on a slope, perhaps wind sorted in some cases since deposition, but certainly not obviously water-laid—or water-disturbed save in a single case, No. 298. As soils, they are all unexpectedly immature, seeing that they have such readily-recognized features in the field, such as changed colour or density, in comparison with the less weathered ashes.

The micromorphology of the basal sandy reddish braunlehm soil (Bed 4) (unnumbered) makes it probable that this weathering-event corresponds with that giving rise to the similar soils of the 'Upper Red Soil' Series in the motorway sections, in which case it would be dated somewhat before 30,000 years B.P. and be due to a climatic environment considerably moister, supporting a much richer flora than that of the area at the present day.

The clay immediately above the red soil, Bed 4, and its hard top (Beds 5, 6) are distinctly pink in colour. The only other pinkish horizon in the whole exposure is the slightly reddened top of the Upper Café (Bed 13). It is clear, therefore, that, even in the somewhat warmer environment of the Puebla valley, the conditions for red-soil formation were only rarely and not very intensely presented after the time of the formation of the basal red soil. The browner soils are poor in colloids and are frankly closer to Braunerde than Braunlehm when they can be recognized as soils at all. This corresponds with the situation found in the Río Frío Series along the motorway. They denote cooler and/or drier conditions.

The Valsequillo archaeological and palaeontological horizon at Site X, containing plentiful Cretaceous chert, is represented by the filling of the stream-channel, Bed 8, which probably correlates, more or less (the exact correspon-

dences depend on a projected survey and levelling of several such channel-remnants known nearby) with the similar deposits at Site Y, Hueyatlaco. The black Cretaceous chert referred to, like lydianite, is a characteristic component of the 'Valsequillo Gravels', which are the principal fossiliferous beds hereabouts. In 1966, during a day spent together in the field, Dr. H. Malde showed the writer that the cherts were directly derived from the Cretaceous outcrop and reached the Alceseca River via a tributary, the Barranca del Muerto. All along the Alceseca, below this confluence, old terrace-gravels containing the cherts are richly fossiliferous. The chert is found, at Sites X and Y (among others) only in the fills of shallow stream-channels, which are also almost the only fossiliferous beds there. The old Alceseca is evidently their immediate source here, also.

SAMPLES COLLECTED IN 1968

The encouraging results obtained from the 1966 samples pointed to several questions of correlation which seemed likely fairly readily to be answerable, one way or the other, by comparison with the known samples of new thin sections taken from the deposits in question.

In the first place, the confirmation by micromorphological similarity of the correspondence of several red-soil exposures with the 'type-series' from Sites A to E was a necessary step. A list of the samples taken in the 1968 season appears as Appendix C.

A pair of reddish soils (Nos. 1, 2) from a series overlying the cinder-cone deposits of the volcano Cerro Cocotitlán, between Chalco and Tlalmanalco, were formerly inaccessible because exposed only in the section of the overburden of a 30-metre vertical quarry-face. They were now reached by new works to remove this overburden for some distance back from the quarry-edge. The best-developed was the lower of the pair (No. 2) which, in thin section, proved closely to resemble the 'Marker' ('Lower Red-Soil' Series), having many voids, with a rotlehm structure and optical properties. The other (No. 1) showed only braunerde features and it is thus impossible to assign it with any assurance to either Series. In the former quarry-face section these two weathering-horizons were only the lowermost of five or more seen in 1966, so it seems likely that No. 2 sample, here, does, indeed, represent the 'Marker'.

Samples Nos. 3 and 4 came, respectively, from the presumed 'Marker' and from the uppermost, best-developed member of the 'Upper Red-Soil' Series at Site L. The identity of No. 3 with the type from Site D was easily established. The 'First Red Soil', once more, was not securely recognizable in Sample No. 4, taken at an easily-accessible point at the extreme eastern end of the exposure. A repeat-sample, (No. 68) from a place reached by some scrambling, but unassailably *in situ* and representative, is a fully-developed braunlehm, like the type, No. 217 of 1966. It was formed on an ash containing numerous

shards of glass, like those of an ignimbrite. This feature was useful in correlating the horizon with one of the numerous members of the Upper Series at Site M (below) evidently formed on the same, easily-recognized, ash-fall.

The very first exposure of red soils on the Motorway, below Site A, about 2 km. east of the Chalco junction, had been cleaned up since 1966 by fresh work in the pit on the north side of the motorway. The two weathered horizons exposed were both assignable, on examination of the thin sections (Samples Nos. 5 and 6), to the Upper Series, as might have been expected from their position, within a metre or two of the modern surface. The cut was too shallow to show the 'Marker'.

At Site M, the representative of the 'Marker' (Sample 10) proved, at sight of the thin section, to be a good rotlehm, confirming this formerly only stratigraphical correlation and removing any doubts (some had been entertained, on the ground of its macroscopic appearance, not quite typical) as to its identity. Three of the Upper weathered horizons, the third (No. 9), and the fourth (No. 8) above the 'Marker' and the uppermost (No. 7), forming the present eroded surface, were sampled. Of these, No. 9 was a good braunlehm, with glass shards (as in No. 68, above), though these were not as numerous as in the former example. No. 9 is thus clearly the representative of the 'First Red Soil' at Site M, formed on the same ash-fall. No other samples at sites nearby, or close to it in the stratigraphical sequence, shared this feature. No. 8 had some colloids, but seemed to be somewhat disturbed, while No. 7 was immature, without colloids—a braunerde. These perhaps rather belong to the Río Frío Series, being later than the typical 'First Red Soil'. This conclusion was supported by the discovery of coarse pumice lapilli and some andesites of comparable size scattered over the eroded surface, evidently rounded in shape and so derived, but nevertheless clearly local representatives of the coarse pumice-with-andesites (Pumice κ), elsewhere occurring near the summit of the Río Frío Series.

Red soils from Site N (Samples No. 12, regarded as the 'Marker' because of the 20–cm. fresh, loose pumice *in situ* 1 m. above it (Pumice ε ?), and No. 11, perhaps the 'First Red Soil') were found, in thin section, to be atypical. No. 12 indeed showed some rotlehm features but was incompletely developed, having still considerable amounts of hydrous and anisotropic colloids. No. 11 was also immature for a braunlehm, having reached only the parabraunerde stage, with colloid accumulations only in conducting channels, not in the finer fabric. The exposure is on a north-facing slope and is clearly incomplete in that only a single, immature, member of the Upper Series is represented. Not only, therefore, has there quite possibly been some periglacial erosion in this situation (we are still between 2,550 and 2,600 m.), but the northern exposure would make for a distinctly cooler microclimate and so, perhaps, account for the immaturity of the soils. Macroscopically, the supposed 'Marker'

horizon looks quite typical. A sample of the pumice is to be examined for comparison with Nos. 258, 258A of 1966 (Pumice ε) and may resolve this question.

Sites Q and S were next sampled—red soils beneath pumices-with-biotite—Samples Nos. 14 and 15. Both proved to be very immature, as red soils, no more than parabraunerdes, or at least braunlehms with only limited colloid development. They are, however, certainly nothing like the 'Marker', and so, quite certainly, belong either to the 'Upper Red-Soil' Series or to some later phase of similar conditions. The sites are both close to river-level, on the floor of the Puebla Valley.

A pair of red soils, seen quite by chance in a fairly deep roadside borrow pit, near Teotihuacán, Mexico State (Km. 19 on the new motorway) was sampled and sectioned. The upper (No. 33) was separated from the lower (32) by a thick bed of relatively unweathered pale grey ash. The former was an undoubted braunlehm, and so should belong to the Upper Series, the latter, though very red and on the whole dehydrated, nevertheless has thin coatings of pale anisotropic colloids in open fissures. These look recent and may be secondary features. Otherwise the soil would consort acceptably with the 'Marker'. There are, however, no 'ghosts' of colloids and if those present are indeed original the soil cannot represent the 'Marker' but must be assigned to the Upper Series. Its fairly shallow depth 5–6 m. below surface depends, of course, on local air-sedimentation rates, but at this depth, on the Mexico-Puebla motorway, a soil would probably belong to the Upper Series, the 'Marker' often lying at 10 m. below surface or more.

Samples 64, 65, 66 and 67 were from red-brown soils, generally from below a cover of 8 m. or so of yellow redistributed ash, this latter being sometimes subdivided by pumices, occurring in deep stream-gullies on the eastern flank of Iztaccíhuatl. They all show dehydrated colloids in greater or less degree and are therefore tentatively assigned to the 'Marker' climatic stage. The stratigraphy of these sometimes enormous (up to 100 m.) sections has not yet been studied in detail, but red soils, as far as can be seen, are scarce in them and confined to the uppermost part. If the above attribution is right, it would seem that the Upper Series is missing. This suggests, either that, in this area, the 'Upper Red-Soil' Series has been eroded, or that aerial deposition of ash was so continuous during the period of their formation elsewhere that they were never formed at all.

The thin sections so far, then, show that, though occurring at widely-separated sites (Teotihuacán lies 50 km. north of Cocotitlan and Chalco 30 km. west of Site S), the two series of red soils are generally readily recognizable by their micromorphology wherever they are exposed in the considerable area so delimited. The technique is not infallible, however, because, unless the samples concerned come from reasonably mature profiles, their microscopic characters are sometimes not clear enough for reliable determinations.

No. 56 was a repeat-sample from the basal red soil at Site U (see No. 301 of the 1966 series of samples, p. 37). In 1966 both this and the overlying pumice-with-biotite were sampled for comparison with the other red soils (e.g. at Sites Q, R, S, T) found associated with pumices of this character. In all of those, the soil proved to be a well-developed braunlehm, while in this case it was an unmistakable rotlehm with dehydrated colloids. The pumice, unlike the others, which were clearly *in situ*, was evidently, here, redeposited by water, but so pure and unmixed with other sediments that, though derived, it certainly could not have travelled far from its original position. The fact of its derivation, however, combined with its association with a soil of the Lower, rather than of the Upper Series, threw doubt upon the conclusion that it was, in time, even approximately, immediately sequent to the soil.

The site was revisited and the second sample taken and it was now seen that the pumice was a much later stream-laid sediment resting on the eroded surface of an ancient red soil in the floor of the gully. Traced into the gully wall, this soil was found to be covered by a thick series of subaerial sediments *in situ*, the erosion of which has bared its surface, on which the pumice had then been secondarily deposited. This solved the problem: there was a huge disconformity between the two. Sample 56 showed the rotlehm features, as had its predecessor, 301, confirming its attribution to the Lower Red-Soil Series.

Sample No. 69 was from a red soil noted in passing in a gully near Km. 22/71 of the Puebla/Vera Cruz railway-line. At low magnification the specimen resembled a parabraunerde by its locally thick clay/iron colloid accumulation in conducting channels, but under higher power the whole fabric was seen to be permeated by flecks of anisotropic colloids and so showed it to be a fairly mature braunlehm, assignable to the Upper Series of red soils. The example serves to extend the area in which this very characteristic soil-type occurs for some 22 kilometres east of Puebla.

No. 71 was taken from a red soil developed at the summit of a thick mudflow. Its surface was covered by a loose, sandy pumice-with-biotite in an erosion-gully fairly low on the southern flank of La Malinche. This is only one of many such exposures observed in an air-traverse of the area. The sample closely resembles No. 69 (above) and is also assigned to the Upper Series.

Finally, No. 74 represents a reddish soil formed on fine clayey sediment from the fossiliferous site of Arenillas, close to Totimehuacán, in the Alceseca River valley. The parent material, a fine subaerial ash, is here seen directly overlying the 'xalnene' (Bed 2 at Site X) and is covered, in its turn, by a thick deposit of grey clayey peptized material, the weathering of which results in a talus of pale crumbs. This latter one would unhesitatingly correlate, by its properties in the field, with Bed 7 at Site X. The soil, therefore, probably corresponds stratigraphically with the slightly hardened layer, called Bed 6

at Site X, itself a soil formed on Bed 5, a peptized pinkish-grey clayey ash. Bed 4 (a braunlehm developed on relatively unweathered, though consolidated, sandy ash) and its parent, Bed 3, appear to be missing at Arenillas, whether eroded or never deposited is not clear. Microscopically, the sample is a fairly mature braunlehm with anisotropic colloids throughout, though without distinct flow-structures or stratified colloidal deposits in fissures. It thus corresponds reasonably well with Sample No. 283 of 1966, taken from Bed 6 at Site X and is evidently a member of the Upper Series.

Cynthia Irwin-Williams, in her preliminary report to I.N.A.H. (unpublished) on her 1966 excavation at Hueyatlaco refers to a 'reddish sterile clay' found beneath the channel-fills in the deepest trench. A trial pit was dug for the present writer in March 1968, near the edge of her excavation, to a depth of 1.5 m. This was intended to obtain a sample of the material for comparison with Sample 283 of 1966 and with No. 74 (above). Unfortunately, the water-level in the reservoir was still so high at this date that groundwater filled the pit before the bed in question was reached. Stratigraphically-speaking, this clay at Site Y may be supposed to correspond with the foregoing samples and, if so, would provide a valuable horizon for correlation with the more detailed sequence, all above water-level, at Site X.

Eight of the red soils from various sites were examined by the Dept. of Prehistory for pollen, but none was found.

Sites W and Y

The exposures at Cerro de Loreto, Puebla (Site W) and at Hueyatlaco (Site Y) were fully sampled for thin-section study and for comparison and correlation with Site X (already described, p. 31 ff).

Site W

Bed 1 at this site (Sample No. 17) proved, as before (p. 34), to be a good braunlehm, and so is most likely to correspond with Bed 4 at Site X. This is the key-point for the correlation suggested between these two sites.

Sample No. 18 (Bed 2) represents a yellowish-grey clay which forms a talus of crumbs on drying. Under low power it seems to have scanty colloids mainly in the form of flow-structures, but at higher magnification they are seen to permeate the extremely fine-grained fabric also.

No. 19, Bed 3. The bed stands out as a rather harder shelf. The section shows braunlehm colloids more prominently than the preceding sample, and these form not only the easily visible flow structures but also permeate the fabric completely. The colloids are very pale in colour, apparently containing very little ferric iron.

No. 20, Bed 4. This is a thick deposit of grey-brown peptized clay, like No. 18, though somewhat darker in colour, but microscopically almost identical.

No. 21, Bed 5a. This is a well-sorted coarse-sandy material which contains much pumice but is by no means a pure pumice, with 'golden' (i.e. weathered) biotite. It stands out as a prominent 'step', resistant to modern erosion, probably owing to its sandy grading. Under higher power, colloids are seen to permeate its whole fabric.

At its summit, Bed 5b, represented by Sample No. 22, is a weathering-profile on a stable surface of the deposit represented by No. 5a. As a soil, it is an immature braunlehm with pale yellow colloids, not only lining fissures but in the fabric also.

No. 23, Bed 6, is another peptized clay, brown in colour when moist, but, on drying out, forming a loose talus of almost white crumbs. Colloids are not prominent at low power, but as the physical properties show, are distributed evenly throughout the fabric.

Bed 7, again, forms a slight 'step'. Its lower part (Sample No. 24) has some colloids in the fabric, but every hole and fissure is lined with a pale anisotropic filling. Sample 25, from the upper part of Bed 7, shows slight reddening and incipient dehydration of the colloid deposits and so is determined as an immature rotlehm on a braunlehm precursor. The whole of Bed 7 is thus a soil, only its upper part showing rotlehm features and slight reddening, denoting, in all probability, a relatively brief removal, or thinning of its contemporary vegetation-cover.

Bed 8, 1.3 m. thick, forms another clay-crumb talus in the field. Its lowest part, Sample No. 26, is a dark, chocolate-coloured clay, completely peptized and with massive colloid deposits in cracks. There are a few sand-grade mineral crystals, including hornblende, but the material is mostly extremely fine.

Nos. 27 and 28 are of sandier consistency with thick colloid deposits locally, in cracks, but the closer parts of the fabric, away from these, are not noticeably colloidal under low power. Under higher power, however, the entire fabric between the coarser grains is seen to be peptized. *Braunlehm.*

Bed 9 is represented by Samples Nos. 29 and 30. In thin section, the former shows a scarcely weathered sandy ash, but the upper part, though similar in texture, is noticeably redder, both in the hand-specimen and in thin section. Pumice-lapilli are relatively fresh in the former, deeply decayed, with production of colloids, in the latter. The redder part is an immature braunlehm formed on sandy ash. The whole bed, probably because of its coarser texture, stands out as a sharp-edged vertical 'step' 1.25 m. in thickness, mainly of a pale '*café-au-lait*' colour.

Bed 10, Sample No. 31, is the modern soil, formed on a parent material of sandy ash. It is grey-brown in colour and loose and sandy in consistency, though with some slight formation of friable crumbs. Most of the mineral grains look extremely fresh, but the presence of plentiful caliche ($CaCO_3$) at its base, often filling cracks in the surface of Bed 9, must be due to the migration of calcite by percolation, ultimately formed by the breakdown of felspars.

Calc-braunerde or para-chernozem.

Nothing in the sequence, save perhaps the reddened top of Bed 9, in any way resembles the reddish, mature braunlehm soil of Bed 1 (Sample 17), It would appear that the latter belongs to the 'Upper Red-Soil' Series which here lies direct (at an adjacent site) on a lava-flow from the Cerro de Loreto, which thus seems to have been active immediately before, or during the last climatic phase in the region which favoured the formation of mature reddish braunlehm soils. While the soils and sediments above it in the section all have braunlehm features, as their content of colloids shows, none is anything like as mature as this. The valley of Puebla, slightly lower and warmer than that of Mexico, apparently favoured a parabraunerde or braunlehm type of weathering rather than the braunerde type seen in post-Red-Soil times at higher elevations. The presence of a pumice-with-biotite in Bed 5, even if mixed with much finer ash, suggests a point of correlation with the similar pumices at Sites Q to T, on the motorway, only a few kilometres distant from Site W, and with the derived, water-laid pumice at Site U.

Site Y, Hueyatlaco

Samples Nos. 44 and 43 represent a coarse-sandy and a finer water-laid sediment from one of the many intersecting fossiliferous stream-channel fillings just above the March ground-water level. As noted above (p. 44) there seems to be a reddish bed (not seen by the writer) underlying these, probably corresponding (from its description) with Beds 5 or 6 of Site X. If this correlation should prove correct, the more clayey reddish soil should overlie a more intensely red, sandier braunlehm soil of 'Upper Red Soil' affinities, described as Bed 4 at Site X, only a few hundred metres away, near the neck of the peninsula.

No. 44 contains much Cretaceous chert of fine-gravel to coarse-sand grade, pumice and crystalline sand-grains, mainly of felspars. It is very little weathered.

No. 43 is a rather well-graded fine-sand and silty material, again predominantly consisting of felspars, but with many heavier minerals. A fresh stream-sediment, quickly buried and unweathered.

No. 42 represents a peptized clay with some segregation of the colloids and local infiltration of limonite. Like other materials of the sort, it crumbles on drying and falls away from a vertical face in the form of a loose talus. Fundamentally it is a fine redistributed ash, showing some degree of weathering throughout. Its uppermost part (Sample 41) is more weathered, somewhat redder in colour owing to copious infiltration along vertical channels (?root-holes) of limonite. Containing much bentonitic clay, it at first resisted impregnation for thin-sectioning by the available techniques. It is clearly a soil. Later, it was successfully sectioned by Mrs. Barton in London and showed a mature braunlehm, surprisingly (and uniquely) with incipient dehydration of colloids towards rotlehm. An undoubted weathered land-surface.

Sample 40 is from a minutely stratified and cross-bedded well sorted silty white ash with plentiful 'golden' (i.e. somewhat limonitized) biotite flakes. It represents an originally practically unweathered ash-fall redeposited by slowly flowing water. The weathering of the biotites probably took place since its deposition. This is a significant 'marker', almost certainly corresponding with the pumices-with-biotite occurring at Sites X and W, there, in both cases, somewhat above a typical reddish braunlehm soil and, at Site X, directly sealing a channel filled with fine water-laid sediments, though the relative levels have not yet been surveyed.

Sample 39 comes from the lower, sandier, part of a thick (4.0 m.) deposit of pale brown peptized fine ashy sediment. This part shows little sorting, its sandier appearance being due to the presence of coarse to medium-sandy pumice mixed with silt-grade ash. Fissures show a local development of thick colloid lining, but under higher power the fine groundmass is seen, also, to be permeated with colloids.

Sample 38 belongs to the upper part of this bed and is a pale brownish-grey clayey ash, peptized throughout, without perceptible internal stratification. It forms a crumb-talus on drying, unlike the sandier lower part.

Sample No. 37 is the lower of two hard, resistant, pale *café-au-lait*-coloured 'steps' in the section. It is locally crowded with rounded pumice lapilli up to 4 cms. in diameter, with some fewer and smaller hard-rock fragments. In the thin section it shows some slight colloid segregation in fissures—an incipient parabraunerde.

Samples 36 and 35 respectively represent the middle and uppermost parts of a fine, grey-brown silty or clayey bed forming a pale crumb-talus between the two harder 'steps'. No. 36 is peptized throughout, but shows only incipient deposition of fresh colloids in cracks. No. 35 is similar, but with rather more colloid-segregation all round the edges of individual crumbs. It is an immature braunlehm soil.

No. 34 is from the upper, sandy, *café-au-lait*-coloured 'step', which in most places forms the summit of the section, though the modern soil, more easily eroded, covers it at some distance back from the edge of the cliff formed by the rest of the section. It has very few colloid-materials in the fine fabric, but these are plentiful as linings to holes and fissures. It is a parabraunerde on relatively fresh sandy ash and contains some veins of calcite infiltrated from the rather thin modern soil, which, as at all lower and drier situations to-day, is a calc-braunerde or parachernozem, corresponding with the present sub-arid climate.

SUMMARY AND CONCLUSIONS

There is a lack of confirmed stratigraphical connections between Site M, on the motorway, where both the 'Upper' and 'Lower Red-Soil' Series are last fully represented, going eastwards, and Site Q, where, towards the Puebla end of the road, the pumices-with-biotite lying above red soils are first typically displayed.

Comparison of thin-sections of soils now shows fairly conclusively that the basal red soils of the Puebla region are, depending on their relative maturity, typical braunlehms, and so may fairly be assigned, as to their formation, to a period of much moister climate than the present, which, as was to be expected in theory, for a long time affected both Basins similarly.

While the evident differences in the sequence of local accumulative events occurring in the two regions forbids a claim of absolute contemporaneity between any two weathered horizons so widely separated in space, it nevertheless seems justifiable to put their formation within the same ('Upper Red Soil') major climatic phase and so to use them as broad stratigraphical reference-points for correlations between sites. Scattered spot-samples of red soils from a very wide surrounding area show similar characteristics.

Granted so much, it follows that the basal braunlehms underlying the sedimentary and weathering sequences of Sites W, X and Y are the correlatives of the 'Upper Red Soils' of the Sierra and eastern Mexico and Chalco Basins and that the overlying deposits must therefore be, in the wider sense, the local representatives of the Río Frío Series, dated by the *nuée ardente* carbon to a time less than 30,000 years before present.

The pumice-with-andesites, apparently emanating from Popo., found at Tlapacoya III, bears an approximate C^{14} date of 14,700$\pm$ 280 B.P. and is, stratigraphically, considerably later than the obsidian blade, there directly dated by the overlying tree-trunk to 23,150$\pm$ 950 B.P.

While Hueyatlaco (Site Y) yields no directly-datable material, the archaeological and palaeontological finds lie only a metre or two above the basal reddish clay reported by C. Irwin-Williams, beneath a total depth of overburden there amounting to something like 10 m. of ashes and successive immature weathering-horizons. It is, therefore, not unreasonable to suppose that their date lies fairly close to the stratigraphically lower limiting date (30,000+ B.P.), though no upper limit for them can, so far, be given.

In this connection, the pumices-with-biotite seem to have a deciding rôle to play. Occurring, as they do, generally directly on, or not far above, the last well-defined braunlehm soil of the Upper Series, at Hueyatlaco and Site X their representatives *overlie* the fossiliferous levels also, so that, if they can be mineralogically identified and, being so widespread, be found elsewhere associated with organic materials in sufficient concentration to give a C^{14} date, they would provide an upper limiting date for Hueyatlaco and so possibly relate the finds there to the already-dated traces of ancient man in the Chalco Basin.

This result remains, at present, unachieved. Efforts towards the end of the 1968 season to locate possible sources seem to point to La Malinche or the smaller dacitic Pleistocene vents directly to the east of it. Pumices-with-biotite occur in gully-sections all over the southern flank of Malinche and on both sides of the drainage-divide between the Puebla Valley and the closed internal-drainage Basin of Oriental. Whether all represent the same, or even closely-associated, volcanic events cannot as yet be determined, but it is certain that pumices of this character reached the Valsequillo area via the River Alceseca, were deposited both subaerially and among river-alluvia as far west as the Atoyac River Bridge on the motorway and, it may be recalled, an extremely fine-grained pumice or ash with numerous tiny biotite crystals occurs just above the uppermost 'Upper Red Soil' member at Site M, where it was originally concluded that it must be of relatively eastern provenance, since it is unknown further west, along the motorway.

The solution of this problem will require much more fieldwork to fix the probable sources, and petrological comparison of pumice-samples in the laboratory to identify materials emitted by different eruptions, if several are found to have occurred. A possible successful outcome of this undertaking would be a secure 'bracket' of dates about the fossiliferous and archaeological deposits at Hueyatlaco, thus showing their relation to other known and datable early-man sites in the volcanic belt of central Mexico.

ACKNOWLEDGEMENT

The work of the 1968 season was made possible by a generous grant from the Wenner-Gren Foundation for Anthropological Research, of New York, for which the author here records his gratitude.

APPENDIX A—LIST OF SITES EXAMINED AND SAMPLED—1966

Motorway

Sites A and B	Km. 23	Two adjacent road-cuts showing section above the 'Marker'.
C	Km. 25	Sloping cut on left, going east. Section down to just below 'Marker', very oblique to stratification.
D.1	Km. 25·5	Upper part inaccessible. 'Marker' down to Older Lava boulders fully represented.
D.2	Uphill part of the same cut. Pumices above 'Marker' accessible.	
E	Km. 26	Best view of sub-'Marker' layers. Older Lava *in situ*. Marked erosion between Lower and Upper Red-Soil Series.
F	Km. 27·2	Pumices above 'Marker' thicken.
G	Km. 28·5	Pumices ε and ζ very thick.
H	Km. 32	Last section, going east, showing 'Upper Red-Soil' Series dipping in valley below 'Younger Lava'.
R.F. I	Km. 37	Type-section of Río Frío Series. 'Younger Lava' to coarse pumice-with-andesites, complete.
II	Km. 37·2	Less detailed, but confirms the preceding.
III	Km. 45	Just short of Río Frío, on right-hand corner. Slope-washed pumice of *nuée ardente*, thickening, two fine pumices and the coarse pumice-with-andesites.
IV	Km. 52	Between Sites L and M. R.F. Series over the 'Younger Lava', with evidence of erosion and ?periglacial phenomena.
	Km. 45	Río Frío nuée *in situ*.

I	Km. 46	Red soils reappear below 'Younger Lava'.
J	Km. 47·5	Red soils and pumices lying on 'Older Lava'.
K.1	Km. 48	Nuée at modern surface, overlying red soils.
Motorway		
K.2	Km. 48·5	Pumice β, erosion, solifluction-lenses. 'Upper Red-Soil' Series unconformably above.
L	Km. 49	Huge section, comprising the whole sequence from Pumice α up to the Río Frío Series, cut by small normal fault.
M	Km. 55	'Marker' at road-level with another 5 buried soils above. Pumice-with-andesites at summit. Last complete exposure of red-soil Series on Puebla side of Sierra Nevada.
N	Km. 58	(Old road, Km. 75). Red soil (presumed 'Marker') at road-level with sandy pumice above. Pumice-with-andesites just below modern surface.
O	Km. 63	Deep natural gully on right, going east, almost inaccessible. ?'Lower Red-Soil' representative at base, a nuée, a pumice and the ?'Upper Red-Soil' Series above.
P	Km. 64·5	Mudflow?, from Teyotl, covering red soils.
(unlettered)	Km. 76·7	Red soil, stream gravel and mudflow on top.
Q	Km. 99	Just before new Volkswagen factory. Borrow-pit on the right, going east. Brown soil covered with sandy pumice-with-biotite, red soil over.
R	Km. 102·1	Atoyac River Bridge. Pumice-with-biotite on red-brown soil (*in situ*) and (derived) water-laid in low river terrace.
S	Km. 104	Stream-gully close to road on left, going east. Pumice-with-biotite on red soil beneath mudflow.
T	Km. 106·5	On Tlaxcala road branching north from motorway. Pumice-with-biotite on soil, under mudflow.
U	Km. 109·8	Pumice-with-biotite, water-laid in alluvia of stream-gully. Red soil at base, apparently of Lower Series.
V	Stadium excavation, N. of Puebla, by 5 de mayo Monument.	Section in temporary pipe-trench. Pumice-with-biotite under mudflow.
W	Erosion-gullies, N. flank of Fuerte de Loreto.	Red soil at base (Upper Series) and succession of redistributed ashes and soils over.
X	Valsequillo, Tetela road gullies.	Red soil at base, redistributed ashes over. Pumice-with-biotite sealing stream-channel filling.
Y	Valsequillo, Hueyatlaco.	INAH trenches and lake-cliff. Pumice-with-biotite overlying soil, all over fossiliferous stream-cheannel fills. ?Red soil at base, reported by C. I.-W.
Z	Tlapacoya,	Boundary-trenches I and II, correlations with archaeological sites I, II and III.

APPENDIX B—REGISTER OF SAMPLES TAKEN IN 1966

Lab. No.	*Site*	*Description*
214	A	Modern soil with roots, eroding. Parachernozem?
215	A	Brown soil in middle of upper part of section. Parabraunerde?
216	A	Weathered ash, upper part. Braunlehm?
217A	A	Weathered ash, lower part, just above F.R.S.
217	A	'First Red Soil', upper.
218	A	'First Red Soil', lower (parent-material of 217?)
219	A	Relatively unweathered ash above Pumice η
220	A	Ash between Pumices η and ζ
221	A	Pumice ζ, finer upper part
222	A	Pumice ζ, coarser lower part
223	B	Middle of thick ash bed under Pumice ζ
224	B	Bottom of thick ash bed, just above Pumice ε
225	B	Ash under Pumice ε. Part *in situ* (it is slope derived above).

Lab. No.	*Site*	*Description*
226	D.1	'Marker'-soil, summit, loose consistency. Pinkish
227	D.1	„ „ , upper part, showing drip-erosion
228	D.1	„ „ , lower part, dense, still coloured
229	D.1	„ „ , parent material, ash
230	D.1	'Marker', M.2 profile, upper
231	D.1	„ „ „ , middle
232	D.1	„ „ „ , lower (?parent material)
233	D.1	„ M.3 „ , middle
234	D.1	„ M.4 „ , middle
235	D.1	Dense brown ash below 234
236	D.1	Base of ditto, just above 'Older Lava'
237	D.1	Sample of matrix among 'Older Lava' boulders
238	D.2	Pumice η, coarse, with andesites, below
239	D.2	„ „„ finer upper part
240	D.2	„ ζ, fine (?water-laid)
241	E	Lower part of profile M.3 of 'Marker' Series
242	E	Weathered pumice δ
243	E	Ash between pumices δ and γ
244	E	Weathered pumice γ
245	E	Ash between pumices γ and β
246	E	Pumice β, upper part, finer
247	E	„ „„ lower part, coarse
248	E	Soil under pumice β, upper part
249	E	„ „ „ „ lower part
250	E	Ash below soil (?parent material)
251	E	?Soil 1 m. below 248
252	E	Ash, parent of above
253	E	?Soil 1 m. below 251
254	E	Relatively unweathered thick ash (middle)
255	E	„ „ „ „ (base)
256	E	Pumice α, directly upon 'Older Lava'
257	E	Soil under Pumice ε
258	E	Pumice ε, upper part, fine
258A	E	„ „„ lower part, coarser
259	G	Soil under Pumice ε
260	G	Soil below Pumice η
261	B	Pumice η
262	R.F. III	Pumice θ, *nuée ardente*
263	Sacromonte	Red soil, for comparison with 'Marker'
264	G	Pumice ε, very fine basal part
265A	Km. 42·8	Pumice, for comparison with *nuée* (θ)
265	L	Pumice η
266	L	„ ζ
267	L	„ ε
268	L	„ α
269	L	„ β
270	L	„ δ
271	L	„ γ
272	K.2	„ β
273	K.2	Soil under Pumice β
274	K.2	Pumice between α and β (α/β)
275	K.2	Brown soil on 276
276	K.2	Ash with pumice, parent of 275
277	K.2	Yellow ash, relatively unweathered
278	K.2	Coarse pumice-with-andesites, Pumice α?
279	K.2	Finer pumice with brown soil, Pumice α?

Valsequillo, Tetela Road Gullies, Site X

Gully walls (I)	283	Bed 5, pinkish-grey peptized clay
	284	,, 6, upper, harder part of above. ?Soil
	285	,, 9, lower part of second hard step
	286	,, 9, upper part of ditto. ?Soil
	287	,, 8, stream-channel filling, uppermost layer, pumice-with-biotite
	288	,, 10, lower part, crumb-talus between second hard step and the lower café-au-lait hard cap
	289	,, 10, upper part of ditto. ?Soil
	290	,, 11, lower hard café-au-lait cap
	291	,, 12, crumb-talus between lower and upper hard café
	292	,, 13, upper hard café, lower part, relatively unweathered
	293	,, 13, ,, ,, ,, , reddish upper part. ?Soil
Outlier (II)	294	,, 5, duplicate of 283
	295	,, 6, ,, ,, 284
	296	,, 7, grey crumbly clay, forming talus, cut by stream-channel
	297	,, 9, ?Soil at summit of grey clay (=285)
	298	,, 10, base (=288), yellow-brown ash, somewhat disturbed
	299	,, 10, modern parachernozem soil on Bed 10 material

Hueyatlaco archaeological site (INAH, Tr.I)

300 Fine pumice-with-biotite, water-laid, on reddish soil over stream-channel fillings with fossils

Site U.2

301 Basal red bed *in situ*, for comparison with 'Marker'

302 Water-laid pumice and ash

Site X

303 Valsequillo, Tetela Road, 3rd gully. Supposed 'soil' below the 'xalnene', probably represents Bed 1 material, only slightly weathered.

304 Site T, Tlaxcala Road junction with motorway. Sandy pumice-with-biotite

305 Tetela Road gully, Bed 7. Grey clay involved in modern soil-formation, with humus.

306 Ditto, hardly altered subsoil, representative of Bed 7 generally.

Not numbered (for thin-sectioning only)

Valsequillo, Tetela Road, sandy red Bed 4, for comparison with motorway red soils.

Fuerte de Loreto, Site W, basal red sandy bed, for comparison with above and with motorway red soils.

APPENDIX C—REGISTER OF SAMPLES TAKEN IN 1968

No.	*Site*	*Description*
1.	Cocotitlán	Upper red soil (?'Marker', ?F.R.S.)
2.	,,	Lowest red soil (?'Marker', ?F.R.S.)
3.	Site L	'Marker'-soil
4.	,,	Uppermost member, F.R.S. (Repeated: see No. 68)
5.	Chalco	Upper of two red soils dipping below lake-deposits
6.	,,	Lower red soil
7.	Site M	Soil, 5th above 'Marker', at present surface (not modern)
8.	,,	4th soil above 'Marker' (?F.R.S.)
9.	,,	3rd ,, ,, ,, ,,
10.	,,	'Marker'
11.	Site N	?F.R.S.
12.	,,	Soil below sandy pumice (?'Marker')
13.	,,	Pumice (?Pumice ε) cf. Nos. 258, 258A of 1966

No.	*Site*	*Description*
14.	Site Q	Soil below Pumice-with-biotite (?F.R.S.)
14A.	,,	,, above ,, ,, ,, ,,
15.	Site S	Red soil below Pumice-with-biotite (?F.R.S.)
16.	,,	Pumice-with-biotite (cf. 300, 302, 287, 304 of 1966)
17.	Site W	Bed 1, red soil lying on lava
18.	,,	Bed 2, grey clay, forming crumb-talus
19.	,,	Bed 3, first hard layer, (formed on Bed 2 material?)
20.	,,	Bed 4, grey-brown clay-talus
21.	,,	Bed 5A, sandy, hardened Pumice-with-biotite (cf. 16 and same 1966 samples)
22.	,,	Bed 5B, hardened grey (Formed on 5A)
23.	,,	Bed 6, dark chocolate-coloured clay
24.	,,	Bed 7A, hard, yellowish (?Soil)
25.	,,	Bed 7B, pinkish coloured upper part of above (?Soil)
26.	,,	Bed 8A, 30 cms. of chocolate clay
27.	,,	Bed 8B(i), brown, with fine pumice-with-biotite, lower part
28.	,,	Bed 8B(ii), upper part of pumice-with-biotite
29.	,,	Bed 9A, hard café shelf, lower part
30.	,,	Bed 9B, ,, ,, ,, , upper part, reddened
31.	,,	Bed 10, loose, blackish modern soil
32.	Teotihuacán, Km. 19	Lower red soil (cf. 'Marker')
33.	,, ,,	Upper red soil (cf. F.R.S.)
34	Hueyatlaco, Site Y	Upper hard café shelf
35.	,,	Clay, upper part, below 34
36.	,,	Clay, lower part, below 34
37.	,,	Second hard café, with pumice and andesites
38.	,,	Grey-brown clay, forming talus below 37
39.	,,	Redder, sandier bed, at base of clay, 38
40.	,,	Water-laid, fine white pumice-with-biotite (cf. No. 300 of 1966)
41.	,,	Reddish soil on grey clay under 40
42.	,,	Lower part of grey clay (subsoil)
43.	,,	Lower pale pumice filling channels, in INAH Tr. 3
44.	,,	Channel-fill with black chert gravel (C. I.-W.'s site)
45.	Site H	Ash and pumice immediately over Younger Lava (Pumice ??)
46.	R.F. I	Pumice θ, lying on Younger Lava
47.	Río Frío	Pumice θ, *nuée ardente* from type-site
48.	Site J.2	Nuée lying directly on red soils
49.	Site M	Lower pumice-with-biotite, lying on main F.R.S. member
50.	,,	Upper, fine white pumice-with-biotite
51.	Site N	Pumice-with-biotite overlying F.R.S.
52.	Site Q	Pumice-with-biotite beneath red soil on ash
53.	Site R.2	Pumice-with-biotite below red soil (?=52)
54.	,,	Water-laid pumice-with-biotite, 2 m. above river-level (?low terrace)
55.	Site U.2	Stream-gully. Water-laid pumice-with-biotite below mudflow and terrace-gravel. (cf. 302 of 1966)
56.	,,	Basal red soil, *in situ* in stream-bed (cf. 301 of 1966)
57.	Site W	Bed 5, coarse-sandy pumice-with-biotite
58.	Site X	Germans' site. Malde's "white ash" from summit of Bed 9 (?no biotite)
59.	,,	Germans' site, pumice-with-biotite from top of channel-fill (cf. 300 of 1966)
60.	,,	Fine, middle part of channel-fill, with pumice-with-biotite
61.	Site T	Coarse-sandy pumice-with-biotite on red soil under mudflow (cf. 304 of 1966)

No.	*Site*	*Description*
62.	R.F. IV	Pumice-with-biotite lying direct on Younger Lava (cf. Nos. 46, 47, 48 hereof)
63.	Site L	High pumice-with-biotite above F.R.S. and in R.F. Series ashes
64.	Domingo Arenas (E. slope of Sierra)	Upper red-brown soil (?'Marker', ?F.R.S.)
65.	,,	Lower red soil in same gully (?'Marker', ?F.R.S.)
66.	Teotlancingo	Basal reddish soil below 8 m. of redist. ash
67.	Teponatzingo	Ditto, but ash includes two pumices above. (?'Marker', ?F.R.S.)
68.	Site L	Uppermost member of F.R.S. (Repeat to check No. 4 hereof)
69.	Km. 22/71, Puebla/ V. Cruz railway	Red soil at bottom of gully (?'Marker', ?F.R.S.)
70.	,, ,,	Brown, hardened pumice-with-biotite
71.	Malinche, S.E.	2nd gully. Red soil below pumice-with-biotite, formed on mudflow. (?F.R.S.)
72.	,, ,,	same site. Pumice-with-biotite
73.	,, , moraine at 4,000 m.	Pumice-with-biotite covering old soil on moraine
74.	Arenillas, near Totimehuacán	Red soil over 'xalnene' and below grey clay. (Beds 4–5, Site X?)

Nos. 13, 16, 21, 45–55, 57–63, 70, 72 and 73 are for mineralogical study and possible correlation, *inter se*, and with 1966 pumices.

The remainder were thin-sectioned for micromorphological examination.

Pleistocene Geochronology in the New Forest, Hampshire

by Earl H. Swanson
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General Considerations

This paper is concerned with the relative chronology of Pleistocene events in the New Forest, and with the relationship of certain human implements to those events.

Research was conducted under the auspices of a Fulbright grant, with the supervision of the late Professor F. E. Zeuner, of the Institute of Archaeology, University of London. Laboratory research on the brickearths and soils was under the guidance of Dr. Ian W. Cornwall, and Mrs. Margaret Barton assisted with analyses of material. Mr. C. E. Everard, of Queen Mary College, has given generously of his time and his knowledge of the area. My wife, Jean, assisted with the field work.

Because many of the data are either uncertain or incomplete, they are presented inductively, and correlations are left for the final section. This means, for instance, that terraces are referred to by height of sea level to which they were probably adjusted, as 185 foot stage rather than Ambersham terrace. It means also that different types of data are segregated, so that they may be examined as they stand.

The New Forest (Fig. 1) offers an almost unparalleled sequence of geological events which may be related to world-wide changes of sea level during the Pleistocene period. These events are reflected most obviously in the gravel terraces of the area, but other evidence exists as well. The starting point for research in the New Forest is Everard's recent study of the Solent River[1]. Though not now in existence as a river, it was responsible for the formation of most of the New Forest terraces. Everard defined twelve terraces, six of which he considered 'major stages'. Some of them have already been correlated with the sequence in the Thames Valley.[2]

Everard depended upon the presence or absence of a longitudinal surface gradient for the identification of a terrace as fluviatile or estuarine. This is

[1] C. E. Everard, 'Solent River', *Trans. Inst. of Brit. Geog.* 20 (1954), 41–58.

[2] S. W. Wooldridge and D. L. Linton, *Structure, Surface and Drainage in South-East England,* The London Geographical Institute, 1955.

a satisfactory criterion if it is implemented by a study of the benches, stratigraphy, and morphology of the sediments. The fact that Everard regards some terraces as fluvial or others as estuarine leaves unanswered the geomorphological question of why some should be fluvial, others estuarine, in positions differentiated by altitude only. Some consideration might be given to the position of the Portsdown anticline on the north, and the Sandown and Brixton anticlines on the south. As a matter of fact, it appears that all of the low terraces

Figure 1 Map of the New Forest showing distribution of gravels and important sections.

are, in one way or another, fluviatile. The situation is rather complex, and the relationship of the existent rivers to the Solent will need further exploration. As will be seen later, the 100-foot stage is fluviatile, though Everard treats it as estuarine or marine (in the sense that Southampton Water is). This is the key terrace. I have included some gravels ascribable to still existent rivers, but most of the New Forest terraces are interfluves between the Avon and Test valleys.

In order to derive a relative chronology, it is necessary to use the principle of glacial eustasy.[3] If this is acceptable, then the terraces should, generally speaking, be the result of high interglacial and interstadial sea levels. Thus, buried channels and knickpoints are evidence of low glacial sea levels, and corroboration should be offered by solifluction and loess. It should be pointed out that Everard's study shows no evidence of tectonic disturbance subsequent to the formation of the New Forest terraces. Since these phenomena are adjusted to sea level, it should be possible to make altimetric correlations with other areas as well, though such correlations are full of pitfalls. Everard's estimates of sea level are based on the aggradation surfaces of the terraces. Here, benches are used as well. In several instances bevels and strandlines not recorded by Everard are included. The heights obtained need verification or adjustment based on a larger series of measurements.

The staircase arrangement of the New Forest terraces illustrates the general decline of sea level upon which Pleistocene fluctuations were imposed.[4] From Fritham, near 400 feet, to Barton, about 50 feet, in Christchurch Bay, a distance, as the crow flies, of about 13½ miles, there is an average fall of 2.6 feet per mile. The terraces down to and including the 300-foot stage appear to be on this line of fall, while the later, low terraces appear to be above it (Fig. 2). This may be the result of destruction of lower terraces at Barton by the sea, and/or the fragmentary nature of the terrace remnants. If this apparent condition is real, it may mean that the high terraces are not solely the result of glacial eustasy, but reflect instead the millennial steady fall of the sea since they were deposited. The position of the low terraces above the line of mean fall would thus be the result of glacial eustasy, with compensation existing in buried channels.

In the descriptive portions the term 'stage' is used rather loosely, indicating simply the formation of a terrace, without regard for whether it indicates a major or minor climatic fluctuation. This has been done in order to avoid pre-judging the climatic nature of the terrace gravels by the areal extent of the terrace remnants.

In marshalling the terraces for evaluation, it has been convenient to make a separation, largely arbitrary, between 'high' and 'low' terraces. The latter are below the 300-foot stage (and some gravels at 285 feet in the Avon Valley). This reflects the difference of position with respect to the line of mean fall of sea level and, probably, a climatic difference.

The Preservation of the Gravels

The preservation of the New Forest gravels is in itself a curious feature, at least seemingly so. They are not compact, are usually ill-sorted, and have

[3] F. E. Zeuner, *The Pleistocene Period*, Ray Society, London, 1945. 'Pleistocene Shore Lines', *Geologische Rundschau*, Band 40, Heft 1 (1952) 39–50. *Dating the Past*, Third Edition, Methuen, 1952.

[4] F. E. Zeuner, *The Pleistocene Period*, Ray Society, London, 1945, 250.

been subjected to dissection. They nonetheless persist in recognizable sheets up to 420 feet O.D. Frost weathering is attested in many of the gravels, as is solifluction. Long gravel capped spurs south of Stoney Cross, for instance, show the amount of dissection that has taken place. At Mount Pleasant much of the second aggradation has been removed.

Despite this, most of the gravels appear to have suffered little denudation; the sheets vary from 8–10 feet in thickness. That this is near to the original thickness of most is shown by comparison with the submerged terraces at

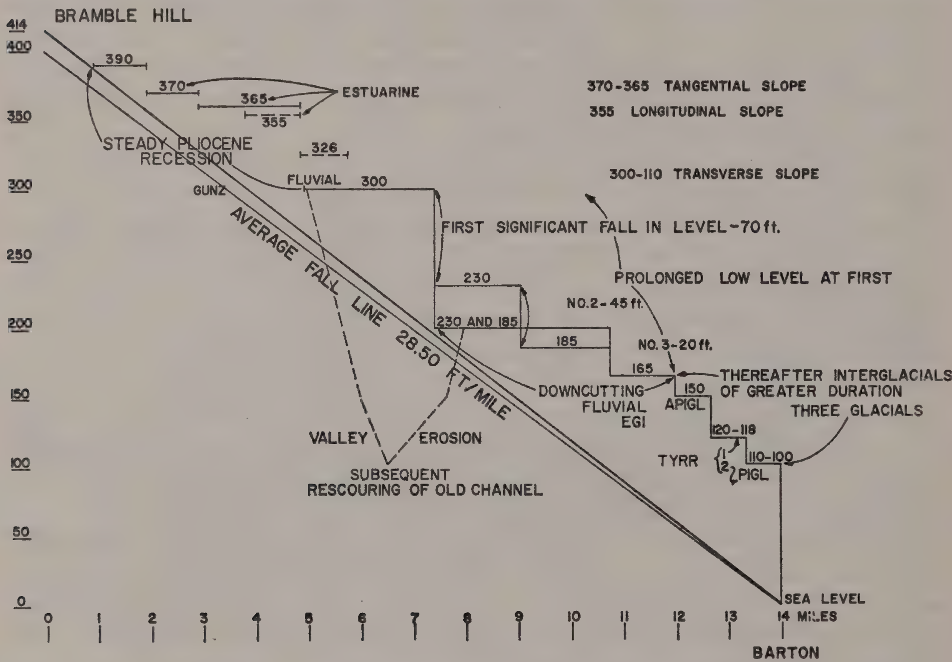


Figure 2 New Forest terraces on the eustatic fall line.

Southampton,[5] which are 8–9 feet thick. These cannot have been subjected to the joint intense weathering suffered by the higher gravel. The exception to this average is the 100-foot terrace, where the gravels are 20 feet thick.

The explanation appears to be partly that the permeability of the gravels readily permits drainage of water to the low water table, at which level it has no effect on their stability; and, secondly, the pebbles are mainly silica. Where other materials have weathered away, the flint pebbles merely settle and the gravels become more compact. During interglacial periods adequate plant cover

[5] C. E. Everard, 'Submerged gravel and peat in Southampton Water', *Hants Field Club and Arch. Soc.* 18, 263–285.

and the breadth of the sheets would have prevented sheet erosion, though channel cutting could have, and did, take place. Such destruction as has occurred is probably due primarily to frost-weathering and solifluction during the glacial periods. Near the heads of tributaries and along the flanks of a stream these processes would be particularly effective, so that it is at margins that destruction has occurred. Since the glacial periods have been shorter than the interglacials, the effects of destruction are less than the factors tending to preserve the gravels.

Examination of present rivers, such as the Lymington, shows no transport of gravel taking place. On the other hand, there is ample evidence of the effects of past solifluction, as at Mount Pleasant, where some six feet of gravel have been removed by sludging. Another example is visible near Bransgore House where headward dissection, which penetrated Tertiary deposits, was followed by two stages of solifluction. The gravels now lie in the channel created by the headward dissection.

The preservation of the gravels is thus not so surprising; their tenacity must be ascribed to those characteristics which might ordinarily be thought to lend themselves to destruction.

The High Terraces

There are eight high terraces, four of which were mapped by Everard[6]. He identified stages at 420, 390, 370, and 300 feet. There appear to be other terrace features, such as a strandline at 365 feet (distinct from the 370 foot stage), and another at about 328 feet. In addition, there is a distinct terrace remnant with its surface at 355 feet, and another at 285 feet.

Everard suggested that the 370-foot stage was marine, but left the decision open because the gravels have a deltaic appearance when viewed on the map. The gravel, however, is not one great sheet extending down to about 340 feet. On the contrary, there is a bevel or 3-foot bluff with its base near 365 feet, though it is blurred by some washing and by plant cover on Stoney Cross Plain. The small vertical height of this bevel makes it slender evidence indeed, and its explanation needs more field work. The lack of foresetting in the gravels of the 370-foot stage makes a deltaic identification unlikely. Another strandline cut into the 370-foot stage occurs near Newtown at approximately 328 feet. The Newtown gravels lack a parallel elsewhere in the New Forest, so that they cannot be identified as either fluvial or marine with certainity. The apparent foresetting suggests a fluvial deposit, but in their present position, they may well have been in an estuary.

The gravels at 355 are at Stoney Cross, near the Compton Arms, and are in a position farthest from the Solent at the 370-foot stage. They are of

[6] *op. cit.* fn. 1.

special interest because they contained Acheulian handaxes.[7] As with the gravel at all stages down to, but not including the 300-foot stage, these are subangular, and may be either estuarine or fluviatile. This terrace remnant indicates marine activity which cut a 14–15-foot bluff at the highest part of the older terraces (370, 390 feet). Although it has no parallel in the New Forest, its position in relation to the long bluff suggests that it represents the presumed course of the late Tertiary, consequent, Test River, as shown by Wooldridge and Linton.[8] It is hereafter referred to as the 355-foot stage though this is probably not the sea level to which it was adjusted. This feature is, of course, too early according to its height for the known age of such implements elsewhere, but this problem will be considered again.

Everard's 300-foot stage is the first definitely fluvial feature, the product of a proto-Avon and the Solent River. The former had a gradient of about $1\frac{1}{2}$ feet per mile; the latter about 10 feet per mile. The expanse of gravel at Picket Post may be the remnant of the former confluence of the two rivers. The upper, higher edge of the proto-Avon floodplain appears to lie near 328 feet $5\frac{1}{2}$ miles ENE of Fordingbridge, on Deadman Hill, and slopes transversely to about 324 feet in one-half mile. East of Picket Post, the upper edge is probably near 320 feet, sloping transversely to 314 feet in five-eighths of a mile. The base level of the Solent at this time is uncertain and Everard estimated it as *c.* 300 feet.

Southwest of Picket Post, and northwest of Burley, there are gravels above Foulford Bottom which have their surface at 285 feet and are 10 feet thick, so that this elevation is probably reliable. They are on the edge of the Avon Valley and undoubtedly represent deposits of that river. At 292 feet, on this segment, there are probable solifluction gravels which came down from the 300-foot stage, though now separated from it by a channel. These lack a parallel in the old course of the Solent River, so that no base level is obtainable. Comparison with the later stages shown in the low terraces leads to a guess that the base level may have been near 260 feet, or even lower.

With the exception of the last-named gravels, the various high terraces succeed each other without interruption. The 300-foot stage differs from the earlier ones in having a measurable longitudinal gradient and in the uniformly smaller size of the gravel. Sorting appears to have been thorough, suggesting that the river was in this position for some period of time. The channel separating the 300-foot stage from the (?) 260-foot stage is subsequent to the formation of both. This leads to the inference that the climate was relatively uniform throughout the period of time represented by the high terraces. There is an essential regularity or uniformity in the steps of recession of the sea, as shown

[7] R. A. Smith, 'Prehistoric Problems in Geology', *Proc. Geol. Ass.* 26, (1915) 1–20.
O. G. S. Crawford, 'The Antiquity of Man in Hampshire I. The New Forest', *Hants Field Club and Arch. Soc.* 9 (1922), 173–178.

[8] *op. cit.* fn. 2, fig. 18.

by the spacing of the stillstands: 420, 390, 370, 355 (345), 328, 300 feet.[9] The 345-foot elevation represents the bench of the Stoney Cross remnant; the 365-foot strandline has been omitted as a minor feature. There appears thus to have been a steady recession of sea level, leading eventually to a purely fluvial drainage system where at first were estuaries. Preservation of the margins, the absence of dissection in the intervals between stillstands, may confirm this. It may be inferred, therefore, that these gravels represent the steady millennial fall of sea level upon which were imposed the later fluctuations of glacial eustasy. There is as yet, therefore, no evidence in the deposits of glaciation, and the high terraces may be treated as one climatic unit, representing a preglacial climate.

In order to summarize, a tentative altimetric comparison with levels of other areas of southern England is offered. The Thames levels are from Wooldridge and Linton[10]; those from Devon and the South Downs are from Zeuner[11], originally given in metres and here transposed into feet.

NEW FOREST	SOUTH DOWNS	THAMES	DEVON	ALTIMETRIC DIVISION
	470.3			
		450–		
420	425.7		425.7	Calabrian
		–420		
390				
370	376.2	370–		————————
355 (345)	341.5	–340	346.5	
328	326.7	320–		
				Sicilian
300	287.1	–290		
260 (?)				

These figures are remarkably close to one another. The apparent absence from the Thames of the uncertain 260-foot stage may not be real, as the Winter Hill terrace[12] may fill the gap.

The Low Terraces

The low terraces (based upon Everard) comprise: 230, 185 (165), 165, 150 (110), 100 (85), 70 (50), 35 and 15-foot stages.[13] In addition, there is a strandline at 50 feet which Everard maps but does not discuss, and one between 120 and 130 feet.[14]

[9] It would have been preferable to express the space between stillstands in terms of variances which might then be compared with variances for the spaces between deposits which are respectively marine and fluviatile in origin. However, this requires a greater number of measurements than I was able to make in the summer of 1955.

[10] *op. cit.* fn. 2.

[11] F. E. Zeuner, 'Pleistocene Shore Lines', *Geologische Rundschau*, Band 40, Heft 1 (1952).

[12] *op. cit.* fn. 2, 101–102.

[13] Figures in parentheses refer to the lower edge of Everard's major horizontal segments.

[14] *op. cit.* fn. 1, 50.

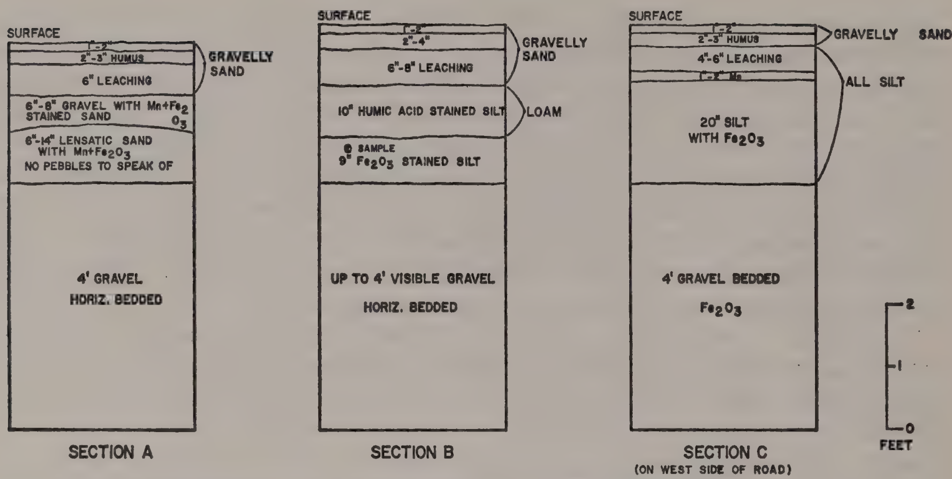
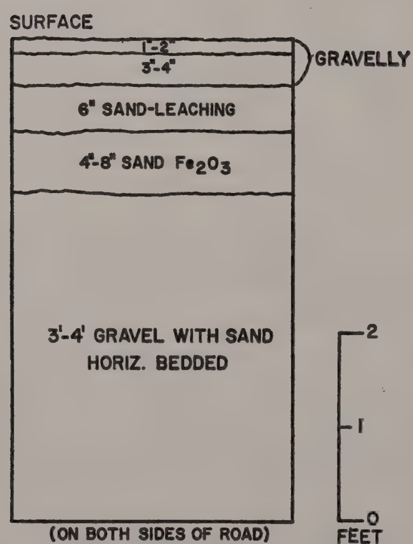


Figure 3 Section at 185 feet at Long Slade Bottom Pit 1.



.5 MILE BETWEEN PITS 1 AND 2
1.3 MILE FROM A-35 TO PIT 1

LONG SLADE BOTTOM PIT 2

Figure 4 Section at 185 feet at Long Slade Bottom Pit 2.

The terraces grading to 230 and 185 feet appear, superficially, to succeed each other without a major episode of downcutting, but the sections of the latter show otherwise (Figs. 3 and 4). Both have been established as fluvial by Everard. A line drawn across the transverse slope of the 185-foot terrace suggests a minor drop in base level of the Solent, if one can judge by the surface elevations. The sections show a gravel deposit at the base, followed by a loam or sand, capped by solifluction gravels. If the terrace is thalassostatic, the gravels at the base would have been laid down in a cold period; if climatic, then the reverse. The paralleling of bench and surface in the later 100-foot terrace suggests that the low terraces are climatic in origin rather than thalassostatic. In any case, there is evidence for a cold phase between the 230- and 185-foot terraces.

The most easterly remnant of the 230-foot terrace in the New Forest is visible at Burley, where it has slumped backward into the Oberwater. At Dur Hill Down, NNE of Shirley Common, there is a gravel sheet which is in a position which suggests that it belongs to the 230-foot terrace, but is at a height which accords with the 185-foot stage. This may be a degraded remnant but if so, some 25 feet of gravel have been removed, which is unlikely. An alternative is to regard these gravels as evidence for the junction of the Avon with the Solent at the time of the 185-foot stage. A third possibility is that they are the remainder of a meander in the 185-foot stage.

A complication arises from the presence of a thin gravel sheet at 175 feet near Lyndhurst, about half-way between the New Forest height of 213 feet and the gravels at 185 feet east of Southampton Water. Everard (oral communication) regards this as a degraded remnant or summit and has not included it on his map of the 185-foot stage. This is as unlikely as with the Dur Hill Down segment. The Solent apparently had at this time a gradient of about $1\frac{1}{2}$ feet per mile, with the Lyndhurst summit six miles east of the 213-foot height. Given this gradient, a fall of some 9 feet is involved and the Lyndhurst gravels would originally have been near 202 feet. Therefore, 25 feet of gravel would have had to be removed by denudation to give the present surface level. Only the gravels of the 100-foot stage approximate to this thickness, and those of the 185-foot stage elsewhere are only about 10 feet thick. An alternative is to suggest a base level below 185 feet and a steeper gradient, but this is unacceptable because of the terrace remnants at 186–184 feet[15] on the Isle of Wight. The most likely explanation is that this gravel-capped summit represents the stage of downcutting which followed the aggradation of the 185-foot terrace. The presence of this Lyndhurst 'leaf' is important in another context, as will be shown later.

According to Everard, the 165-foot terrace is also fluviatile. The section at Poor's Common, near Bransgore (Fig. 5), shows a sequence of deposition

[15] C. E. Everard, *op. cit. fn.* 1

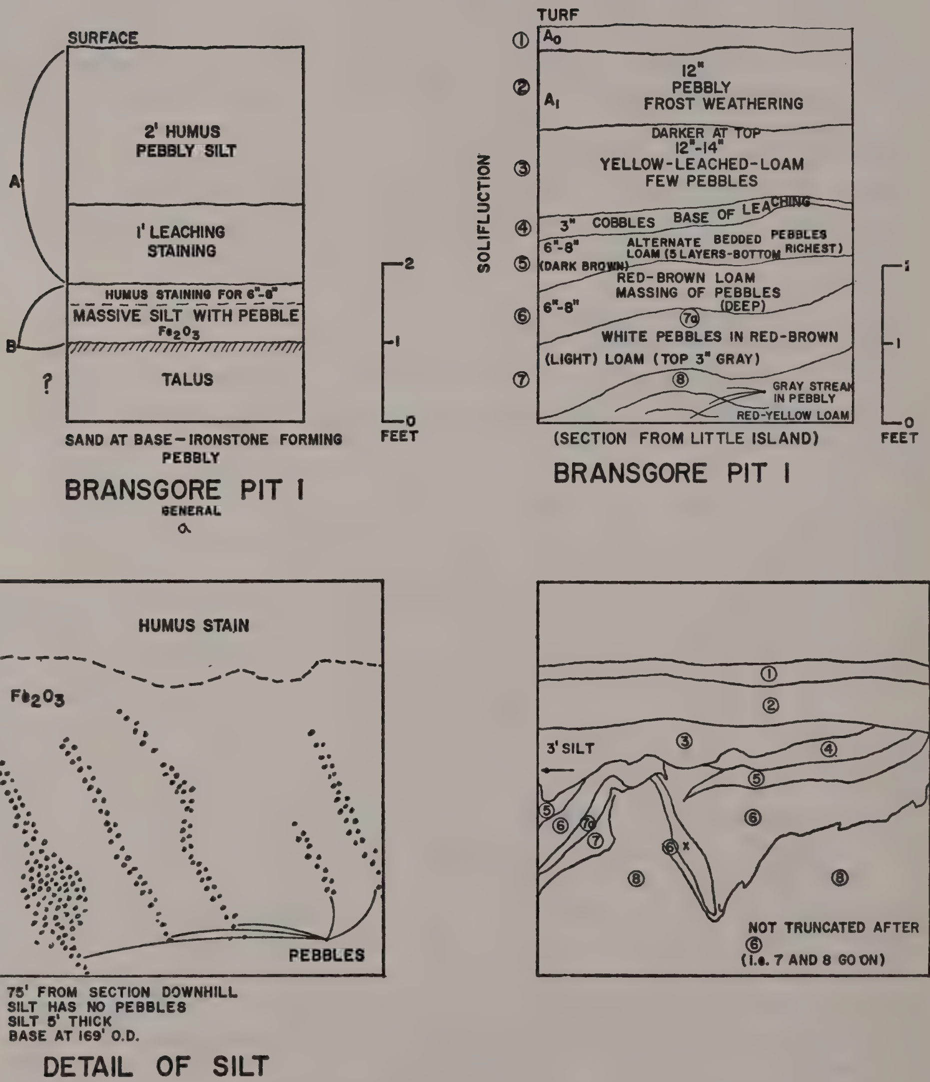


Figure 5 Sections from Bransgore Pit 1 near Poors Common

which conforms to such an interpretation. Subsequent terraces are, however, treated as 'horizontal segments', i.e. without longitudinal slope, and therefore either estuarine or marine. This at first seems reasonable, but a study of the benches of the terraces suggests otherwise. We are forced to return to the question of why terraces differentiated by altitude alone are regarded as fluviatile in one instance and estuarine or marine in another.[16] There is no topographical reason for such a differentiation, i.e. as a cause for such a difference. Presumably, therefore, all of the low terraces should be fluviatile. This appears to be so, but this does not mean that all of the low terraces were formed by the Solent River. On the contrary, several remnants may be ascribed to the activities of the Lymington and other rivers now draining south-southeastward into the present Solent.

The most important terrace is the so-called 100-foot stage, which is composite. It is also the most difficult to interpret. Everard treats this as estuarine or marine. Several sections of this terrace are available for study, at Blackfield, and near Lymington (Mount Pleasant and Boldre), and examination of the benches reveals quite clearly that this terrace cannot be marine (Figs. 6 and 7). It is in fact fluviatile. This does not resolve all the problems, as will be shown, but does account for such data as are now at hand. This terrace is composed of two aggradations, separated by a channel cutting. The second aggradation was interrupted once, and possibly twice. I have already referred to Everard's mention of a bluff between 120 and 130 feet[17] which subdivided his 150-foot stage. This is a local phenomenon and occurs in the New Forest only near Mount Pleasant. It is of some importance in interpreting this stage. It may be a part of the 100-foot stage rather than of the 150-foot stage, marking the left bank of the Solent River in this area at the completion of the second aggradation. Its absence in the eastern part of the New Forest can thus be explained by the change in elevation of the terrace due to the slope of the Solent River.

As the sections show, there was first cut a bench, which has an elevation of 102 feet at Mount Pleasant and 84–85 feet at Blackfield (Pit II). At the latter pit, some of the first aggradation is preserved, but it has been obliterated at Mount Pleasant. At Blackfield II there appeared to be a layer of sand deposited under marine conditions. At the Blackfield Sand Pit, however, it is clear that this is integral with the Headon Beds (Oligocene) which compose the bench. This was confirmed by microscopic examination. The cutting of the bench was followed by the aggradation of a layer of cobbles and then by 7 feet of finer gravel. The total thickness is about 8–9 feet. Comparison with the Longdown leaf (discussed below) suggests that this approximates the original

[16] Dr. Ian W. Cornwall has pointed out in agreement with this observation that 'A further point is that with the millennial fall in sea level continuing, each successive eustatic rise in sea level would flood the estuaries to a lesser extent than its predecessor'.

[17] *op. cit.* fn. 1, 50.

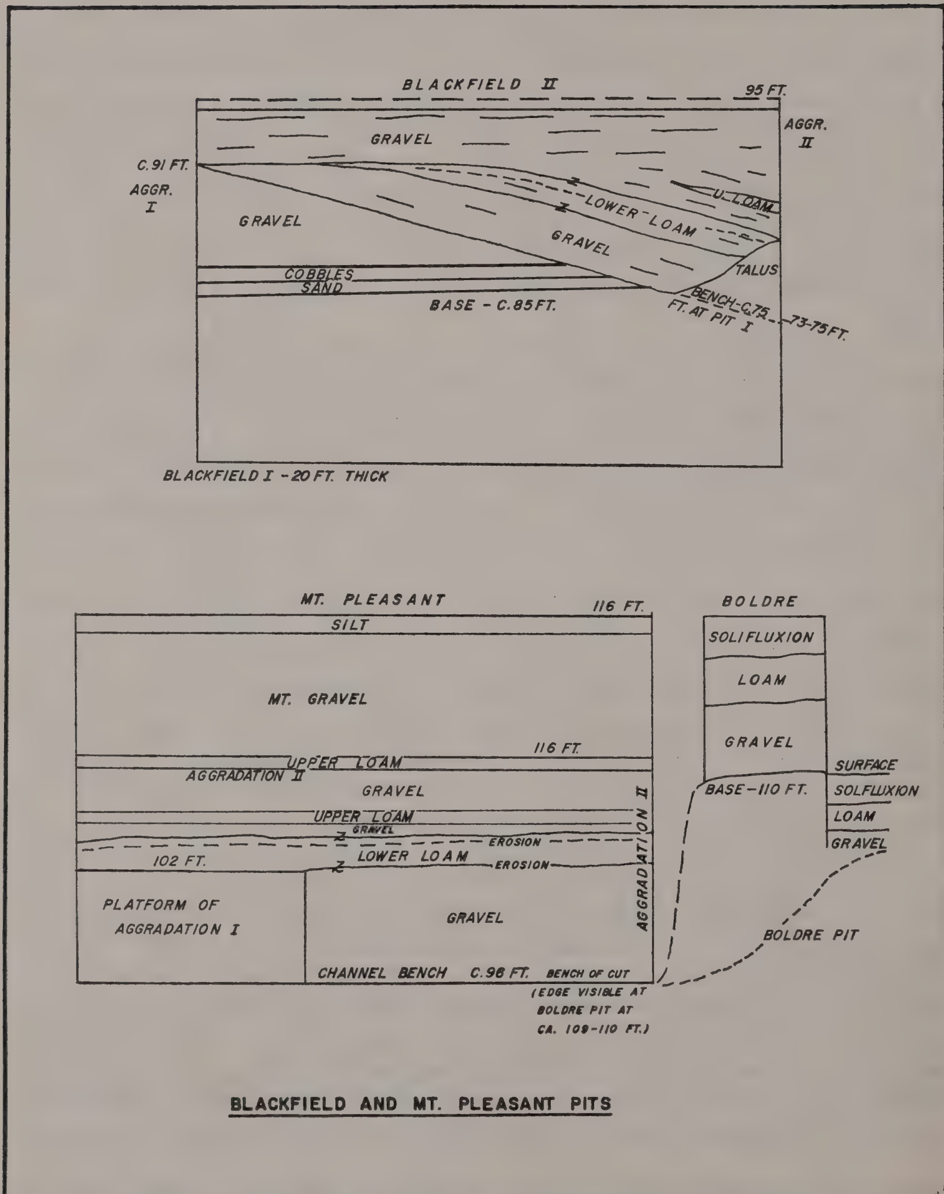


Figure 6 Sections of the 100 foot terrace at Blackfield and Mt. Pleasant.

thickness. The surface of this aggradation is at about 91 feet O.D. This would mean a surface near 111 feet at Mount Pleasant.

Aggradation I was terminated by a period of channel cutting, shown very clearly at Blackfield II, the Blackfield Sand Pit, Boldre, and Mount Pleasant. This channel cut to about 75 feet (best seen in Pit I) at Blackfield and to about 96 feet at Mount Pleasant. The edge of the channel may be seen in the Boldre pit, where it rises to about 110 feet. The channel cutting left the bench of the first aggradation as a 'raised' step in the deposits at Mount Pleasant.

The channel cutting was followed by the second aggradation. Some 8 feet of gravel accumulated, which appears to have a minor erosion surface (such surfaces are marked Z in the sections), and was followed by deposition of a sandy loam (Lower Loam). The loam has a well-marked erosion surface at Mount Pleasant and Blackfield. It was also subjected to weathering, as the upper portion of the loam is more clayey in both places. It is also more compact, while the lower portions of this loam are softer. The period of erosion was followed by the accumulation of more gravel and then another sandy loam (Upper Loam). At this point it is clear at Blackfield that the channel was filled. The final phase is a thick, horizontally bedded gravel, capped by more loam and solifluction deposits. This last loam has been removed by digging operations in most parts of the pits. The second aggradation reaches about 116 feet at Mount Pleasant and about 95 feet at Blackfield. It seems likely that in both places the final surface may be higher by two or more feet.

It is important to note that there is thus a longitudinal gradient of about 2¼ feet per mile. This applies both to surface and to bench, and the parallelism of these two features suggests that the river was above the tidal reach in this area. The pits, with their stratigraphic sequences, ensure that we are dealing with the same phenomena.

A complication arises from a pit just east of Lymington, where the gravel surface is about 95 feet, the bench near 80–81 feet. This is the Bullhill–Norley Enclosure pit, which is 2½ miles from the left bank of the 100-foot terrace as represented at Boldre. If part of the fluviatile Solent River terrace, it means a transverse slope in the bench of the channel cutting of 15 feet in the 2½ miles. This is considerable, but not impossible. On the other hand, the section indicates quite a different accumulation. As against the composite picture at Blackfield and at Mount Pleasant, the aggradation in the Bullhill pit is composed of 14 feet of gravel only, capped by a loam deposit. Everard included it in his marine 100-foot stage, but the difference between Bullhill and Blackfield makes it clear they cannot be treated as one terrace. A tentative explanation can be offered: approximately one-half mile east of the Bullhill pit, across Crockford Bridge on the western edge of Beaulieu Heath, there is a bevel which separates this from the 100-foot stage, trending from NNW to SSE. This suggests that the gravels exposed in the Bullhill pit are the remnants of a Lymington River

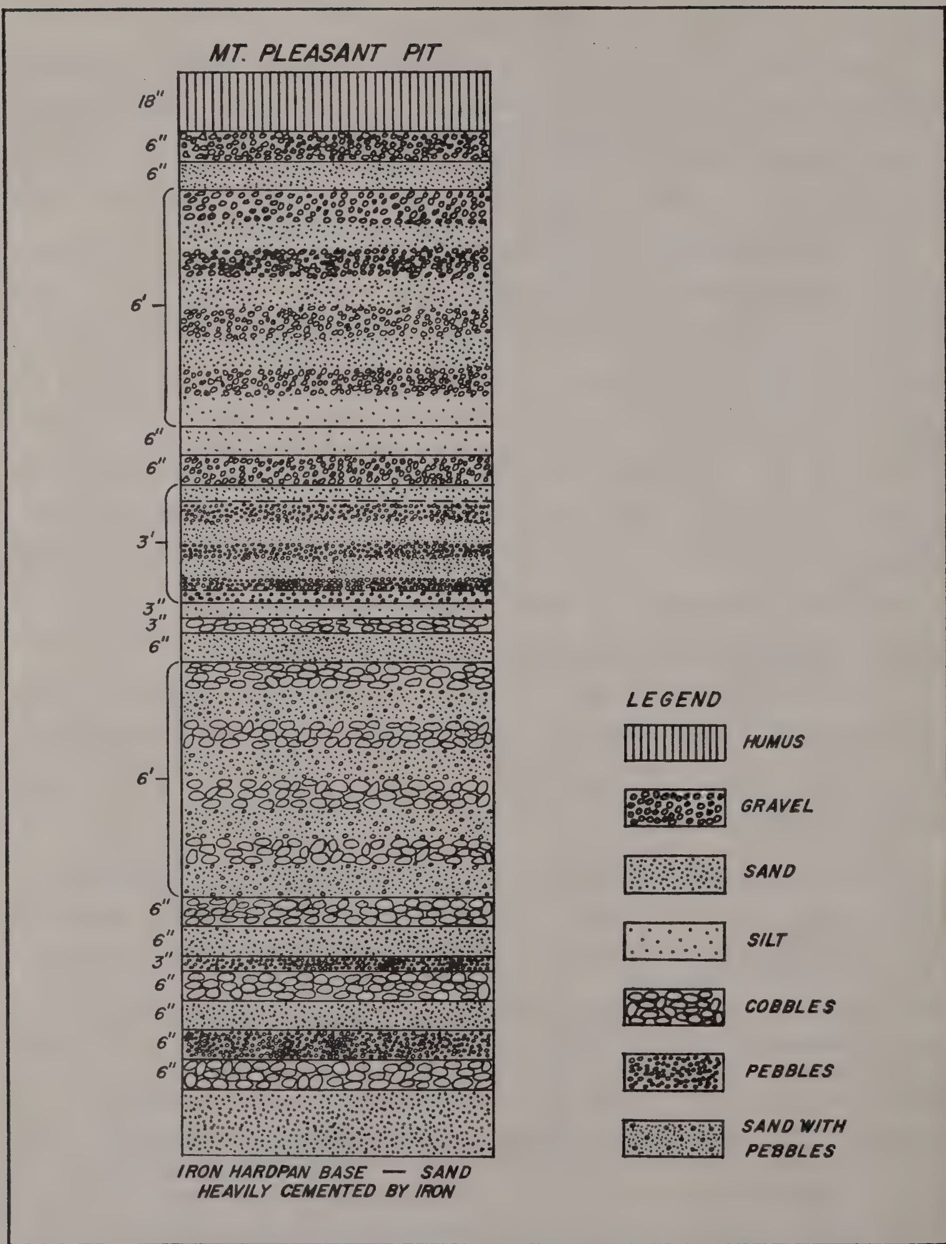


Figure 7 Section of the 100 foot terrace at Mt. Pleasant.

delta, subsequent to the formation of the 100-foot terrace as seen at Mount Pleasant and at Blackfield. There is a parallel for this at 50 feet, shown in Everard's map.[18] The 50-foot remnant succeeds the 70-foot terrace formation. Further, the bench of the Bullhill pit slopes from NNW to SSE, the difference being about 2 feet between the northern and southern edges of the pit.

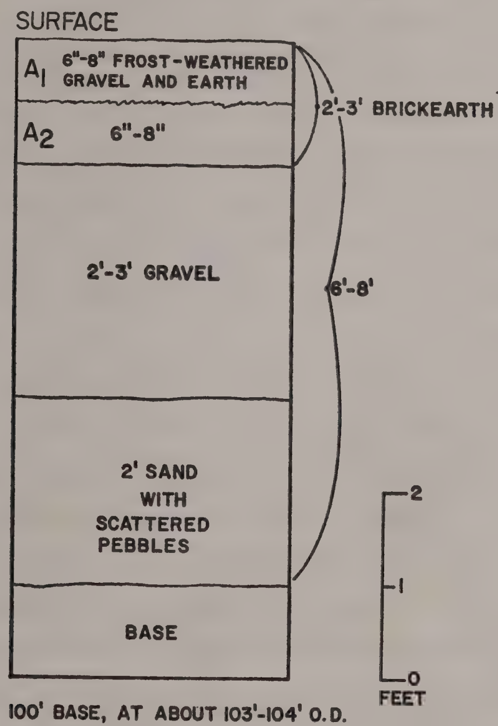


Figure 8 Section of the 100 foot terrace at Longdawn.

In the description of the first aggradation at Blackfield II it was stated that the evidence at Longdown (Fig. 8) suggested that about 8 feet was the total accumulation. This and other remnants in the Test Valley add to the picture of events during the 100-foot stage. In addition to the gravels at 109 feet (bench about 102 feet) at Longdown, there are also gravels at Black Down, and at 106 feet at Applemore Hill which are part of the 100 foot terrace. They reach 116 feet just west of Cadnam. This I have termed the Longdown leaf. At

[18] *op. cit.* fn. 1, fig. 1.

Cadnam there is a drop from the 116-foot gravels to a sheet at 84–85 feet. The Longdown leaf is important because it is so clearly fluviatile, and by its position alone helps to verify the fluvial nature of the Mount Pleasant-Blackfield terrace. The Longdown terrace is 7–8 feet thick, with 2 feet of sand with scattered pebbles, succeeded by 2–3 feet of gravel and 2–3 feet of sandy loam. A projection of its gradient results in both bench and surface coinciding with the bench and surface of the first aggradation at Blackfield II.

The Cadnam leaf must be later than the Longdown leaf because of its more easterly position and lower elevation. The gravels are only 2–3 feet thick throughout the Cadnam area, where they rest on Barton Sand (Eocene). The bench is about 82 feet O.D. It must therefore represent an interval of cutting which followed the aggradation of the Longdown leaf and the first aggradation at Blackfield. It thus parallels the cutting of the channel bench shown in both the Blackfield and Mount Pleasant areas. The second aggradation is not represented on the New Forest side of the Test Valley (as it is in the Solent gravels at Blackfield), but is to be expected at Netley on the eastern side of Southampton Water.

At the time of the 100-foot stage there was in existence a peninsula which deferred eastward the junction of the Test and Solent Rivers. This ridge was formed by the Solent River and is the 150-foot gravel terrace, marked by spot heights of 127, 128, 133, 130, and 144 feet from north of Fawley westward to north of Beaulieu. Everard has treated this too as marine, but the rise of the surface from about 130 feet to 150 feet, near Barton, suggests that it is fluviatile. This is a distance of 12½ miles and gives a surface gradient of about 1½ feet per mile. Everard regards the difference as due to variations in erosion and denudation of the back of the terrace. Verification will depend upon mapping of the bench of this terrace and is the next step to be taken in any study of the New Forest terraces.

It has not been possible to give much attention to Everard's 70-foot stage, which he regards as marine. In view of the fluviatile nature of the 100-foot stage, it seems likely that this terrace is also fluvial. Again, mapping of the bench is called for.

Everard also lists aggradations at 35 and 15 feet. Near Lymington there are two segments with a surface near 50 feet at the back[19] which he regards as deltaic (oral communication). This is suggested by their position and, as already mentioned, provides us with possible corroboration for the deltaic nature of the Bullhill segment which has a surface near 95 feet. There is a strandline at 50 feet in the Test Valley, first pointed out to me near Nursling by Dr. O. G. S. Crawford. It is very clear and there appears to be an estuarine feature of the Test River. The position of the 50-foot remnants near Lymington shows that they have succeeded and obliterated the 60-foot terrace in that area.

[19] *op. cit.* fn. 1, fig. 1.

The 35-foot gravels are widespread in the area covered by Everard's Solent study, but are limited to a small portion of the New Forest on the eastern edge. Everard has omitted a stretch of this terrace which still exists near Hythe and which has a surface near 25 feet. In some areas this terrace rests on London Clay (Eocene), as at Nursling. Everywhere the bottom two feet are cobbles, of considerably larger size than the succeeding seven feet of fine gravel and three feet of brickearth. This, plus their distribution, suggests fluviatile conditions. In this respect, the gravels near Hythe, with their surface near 25 feet, need to be examined. Early fluvial conditions forming the terrace may have been succeeded by the development of an estuary.

The distribution of the 15-foot terrace is confined to the mouths of the Itchen, Test, Lymington, and Beaulieu Rivers, paralleling the deltaic accumulation of the present day.[20] This parallel suggests the reason for the existence of this terrace. In the Test Valley, at Nursling, the gravels rest upon a deposit of shells (including *Pectunculus*— most frequent— *Pleurotoma*, *Natica* (?), *Cardium*, and marine worm casts, all identified by Miss M. Maitland Howard) which belong to the London Clay on which they lie (Castell, British Museum, Natural History, personal communication). Some of the shells are in sand consolidated by iron, others are loose in channels cut into the Clay. Since the shells lie disconformably on the London Clay, they must be derived and redeposited. In the base of the section, in a cluster of cobbles, the teeth of a mammoth were recovered (*Elephas primigenius*, identified by Dr. I. W. Cornwall). The stratigraphic sequence is as follows: pockets of cobbles in a gravel layer 1½ to 2 feet thick, succeeded by sand up to 2 feet in thickness, then 4 feet of gravel, 3 feet of cobbles and, finally, 3 feet of brickearth. The base of the sequence is about present mean sea level, so that it is a thalassostatic fluvial terrace which aggraded to a rising sea level culminating at 14–15 feet O.D.

The preceding description makes it clear that the low terraces of the New Forest are fluviatile in character. Those at 150 and 170 feet need to be examined in this light, with appropriate study of the benches and stratigraphic sequences. It has also become clear that mapping of aggradation surfaces is not sufficient for purposes of either morphological or chronological interpretation of terraces. Most of the low terraces are seen to be the result of the action of the Solent River, with a few complementary terraces still available on the New Forest side of the Test.

Perhaps as important as the composite nature of the 100-foot stage is the existence of deltaic features following the development of the 100-foot terrace. It is best seen in the Lymington area, and there are thus deltaic features at the Bullhill remnant, with later deltaic accumulations at 50 feet (following the 70-foot stage) and at 15 feet. The 35-foot gravels appear to be fluviatile in the Test Valley, but work needs to be done on the sheet at Hythe. The presence

[20] *op. cit.* fn. 1, fig. 1 with 1 inch Ordnance Survey map of the Solent.

of deltaic gravels southeast of Lymington at about 95 feet (at the back) is important because it suggests the time of origin of the Lymington River, and therefore, also of such streams as the Oberwater and the Blackwater, and the Beaulieu River. All of these, the Oberwater and Blackwater excepted, run southeastward into the present Solent. Since these deltas (especially the 95- and 50-foot segments) succeed the preceding terraces of the Solent (the composite 100-foot stage and the 70-foot stage), the Lymington and Beaulieu Rivers must have their origin in a glacial period of low sea level. Because the first evidence follows the 100-foot terrace, the glacial period which succeeded it must have been when these rivers established themselves across and through the Solent River terraces. The deltas are adjusted to a rising base level, so they must be separated from the previous terrace by an interval of low base level, provided by the Solent River for the Lymington. This in turn was adjusted to changes of sea level.

There is, then, the aggradation of the 100-foot terrace as seen at Mount Pleasant and Blackfield, followed by a lowered sea level (lowering thereby the Solent River), which permitted the establishment of the Lymington River across the previous Solent terraces. The next interglacial or interstadial caused a rise in sea level, lifting the Solent River and causing the Lymington to accumulate a delta near its junction with the Solent River, which aggraded the 70-foot terrace. The lower edge of this delta is between 80 and 85 feet, and may have been lower; its back is near 95 feet at the Bullhill pit. The lower edge of the delta of the Beaulieu River, further to the east, should, of course, be somewhat lower than that of the Lymington. Thus it seems likely that the 80–85-foot delta of the Lymington is part of the same interglacial period as the 70-foot Solent River terrace. The same would be true of the 50-foot delta, with its lower edge near 40 feet, and the 35 foot terrace. Each delta-terrace combination is followed by a drop in sea level and then a rise producing a new combination. The next interval results in the 15-foot delta, for which, however, there appears to be no Solent River terrace. This sequence appears to be confirmed by the longitudinal profiles of the Lymington and Beaulieu Rivers (see Section VI). This would mean that the Lymington River, as it now exists, originated in the glacial interval which succeeded the 100-foot terrace. This is an important conclusion, and it makes possible the evaluation of another feature, discussed in Section VI.

If one looks at Everard's map of the Solent terraces[21] the question arises as to what happened to the Solent River at Southampton Water, granting that the terraces are truly fluviatile. Would not such a bend through the Solent past Spithead have been impossible at the time of the 100-foot stage? In the first place, it is not at all impossible since this was the point at which the Test River joined the Solent. In the second place, there was no very sharp bend since the Solent River probably flowed across the low strip of land on the eastern side

[21] *op. cit.* fn. 1, fig. 1.

of Southampton Water now bounded by the towns of Fareham and Gosport, and Drayton and Portsmouth. The disposition of terraces as revealed in Everard's map suggests this very thing. Further, such a situation is paralleled by the present position of the modern Solent. If one raises the objection that this area is now marine rather than fluviatile, and how could the Solent River flow in a marine context, it is pertinent to remember that the sea has breached

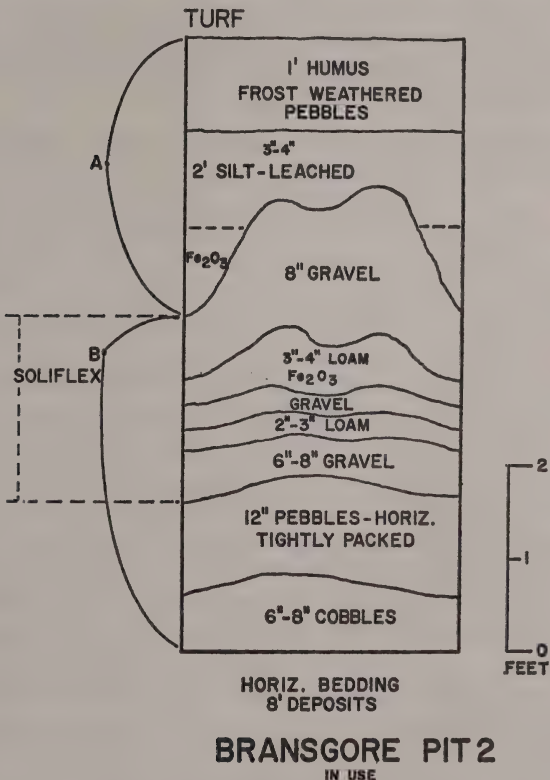


Figure 9 Section at Bransgore Pit 2.

the former right bank of the Solent between the Needles at the west point of the Isle of Wight, and Old Harry Rocks, near Studland, and so destroyed the gradient as well as the stream itself. This undoubtedly affected the Test River as well and led to the establishment of the Solent and Southampton Water as they are today. Everard[22] believes that the breaching of this ridge took place during the Last Glaciation. This seems likely. One further point should be made anent the turning of the Solent River at its junction with the Test River

[22] *op. cit.* fn. 1, 56–58.

in the interglacial periods. This has to do with the Hampshire Basin syncline in which the Solent flowed and which undoubtedly influenced its course. Examination of Chatwin's geological map[23] shows that the Solent River would have had to breach the Portsdown chalk anticline if it were not to make its turn to the sea. Any future work on the Solent River terraces must examine in some detail their relationship to the Hampshire Basin syncline and its associated anticlines.

For purposes of comparisons, the following altimetric summary is provided, with heights for the South Downs and the London Basin derived from Zeuner[24] transposed from metres into feet.

New Forest	*South Downs*	*London Basin*	*Altimetric Division*	*Marine Base Levels*
230				
185	178	198	Milazzian	66 m. = 200 ft.
165			Tyrrhenian	33 m. = 100 ft.
150				
91 (I)	119			
105 (II)	110	106		
80 (?) delta				
70	59–50	60	Main Monastirian	15 m. = 50 ft.
40 (?) delta				
35	26–17	25	Late Monastirian	7.5 m. = 25 ft.
15 deltas				
	3	7	Epi-Monastirian	2.5 m. = 7.5 ft.

Although the surface of the second aggradation at Blackfield is about 95 feet, the more protected left edge is about 103–105 feet and it seems likely that at Blackfield some part of the surface has been cut away by solifluction. If, as seems probable, the 150- and 70-foot terraces are fluviatile, they may prove to grade to sea levels somewhat lower than those given. The Hythe segment, at 25 feet, must also be reconsidered. The presence of the 35-foot terrace only at the eastern tip of the New Forest[25] is partly due to the lateral shift of the Solent River as it moved further southeastward with each glacial interval, never quite regaining its old course in the next interglacials. It is also partly due to the aggradation and erosional activities of the Lymington and Beaulieu Rivers which led to the formation of the 15-foot delta.

The estimated Epi-Monastirian sea level of 15 feet for the deltas in the New Forest is somewhat greater than in the London Basin, but agrees with the Epi-Monastirian at Gorham's Cave.[26] It is within the range of heights for the sea level of that interstadial.

[23] C. P. Chatwin, *The Hampshire Basin and Adjoining Areas*, British Regional Geology, HMSO, 1936.

[24] *op. cit.* fn. 11.

[25] *op. cit.* fn. 1, fig. 1.

[26] F. E. Zeuner, 'The Chronology of the Mousterian at Gorham's Cave, Gibraltar', *PPS* 19 (1953) 180–188.

Solifluction Deposits

Solifluction deposits record the effects of periglacial climate and may be of chronological use. This depends upon their relationship to any given terrace or sets of terraces. Evidence of this is available throughout the New Forest, but only limited instances, with present data, are of some chronological value.

Those which are of importance occur at Foulford Bottom, Bransgore, Boldre, and Mudeford. It has already been suggested that the solifluction gravel at Foulford Bottom was derived from the 300-foot stage near Picket Post, sludged on to a terrace at 285 feet in the Avon Valley which may have graded to near 260 feet. The two stages are now separated by a channel. If the separation could be shown to have occurred between the time of the (?) 260-foot stage and that grading to 230 feet, it would be corroborative evidence for the earliest glacial age recorded in the New Forest.

The gravels at Bransgore (Fig. 9) are at the highest part of the 165-foot terrace in the west of the New Forest, where two solifluctions are visible. One section is in the terrace proper, one is off the edge. Whether these represent two major or minor periods is uncertain. At Boldre, solifluction gravels cap the 100-foot terrace and have cut into it. In addition, the gravels are contorted by frost-weathering beneath the solifluction deposit. Thus there is evidence for two cold periods[27]. A similar situation exists at Mount Pleasant where, however, the solifluction gravel has been sludged into the adjacent stream valley.

At Mudeford (Fig. 10), near the mouth of the Avon River Valley, there appear to be two, and possibly three, solifluction deposits sloping on to a terrace whose bench at that point is at about 5 feet O.D. The solifluctions have cut into the terrace gravels, so that the original height of the surface is not clear. The surface of the most recent solifluction sheet lies at about 18 feet. This may approximate the original height of the terrace and allows me to suggest that the terrace, before alteration by solifluction, graded to Epi-Monastirian sea level. On the other hand, if the thickness of the fluvial gravel at the base is its true, full, thickness, this terrace may be the lower leaf of an older glacial period terrace. It is difficult to be certain at present.

Not one of the solifluction deposits has as yet a very precise chronological value, but they are nonetheless important in describing the climatic succession in the region.

River Profiles

Profiles of the Avon, Lymington, and Beaulieu Rivers have been constructed, based upon the six-inch geological maps of the Ordnance Survey (Figs. 11, 12 and 13). Spot heights and contours have been used for this process,

[27] It is possible that only one cold period is recorded here. My estimate of two cold periods is based on an observation that frost-weathering appeared to precede the soil formation which was later eroded by the solifluction deposits.

as facilities were not available for plane-tabling. Two tributaries of the Lymington—the Oberwater and the Blackwater—have also been included. Similar features appear in approximately similar relationships in the profiles, so that they are probably of the right order.

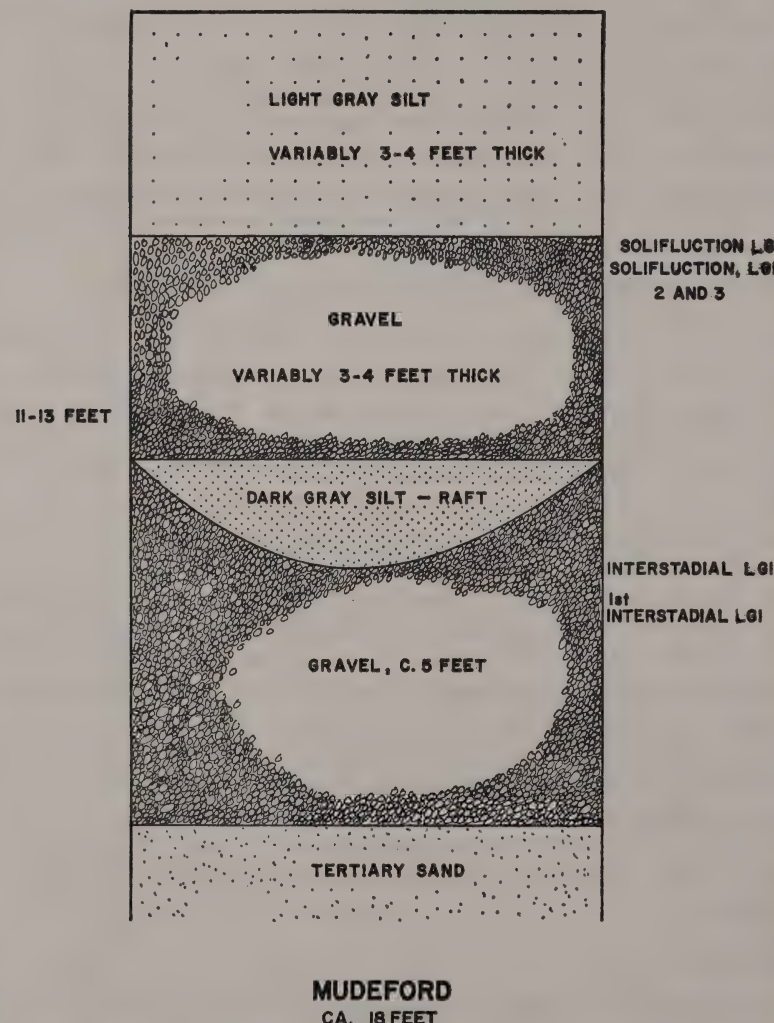


Figure 10 Section at Mudeford.

The longitudinal profiles show both retrogressive erosion (knickpoints) and deltaic aggradation. These appear in sequence and may offer corroboration for the interpretation of the delta-terrace relationships of the Lymington and

Solent Rivers, as previously discussed. Although the Beaulieu area has not been examined for these delta-terrace combinations, the similarity of the Beaulieu River thalweg-curve to that of the Lymington suggests that they are there for future study.

Knickpoints are present as follows: at 77 feet in the Blackwater and Oberwater, which are tributaries of the Lymington River; none in the flatter Beaulieu River; 72 feet in the Avon River. There is also a higher knickpoint at 96 feet in the Avon. If it is correct to infer that the Lymington River originated after the 100-foot stage, then there should not be any higher knickpoint in either that or the Beaulieu, and this is, in fact, the situation. The knickpoint at about 75 feet may occur in one of the tributaries of the Beaulieu. These are

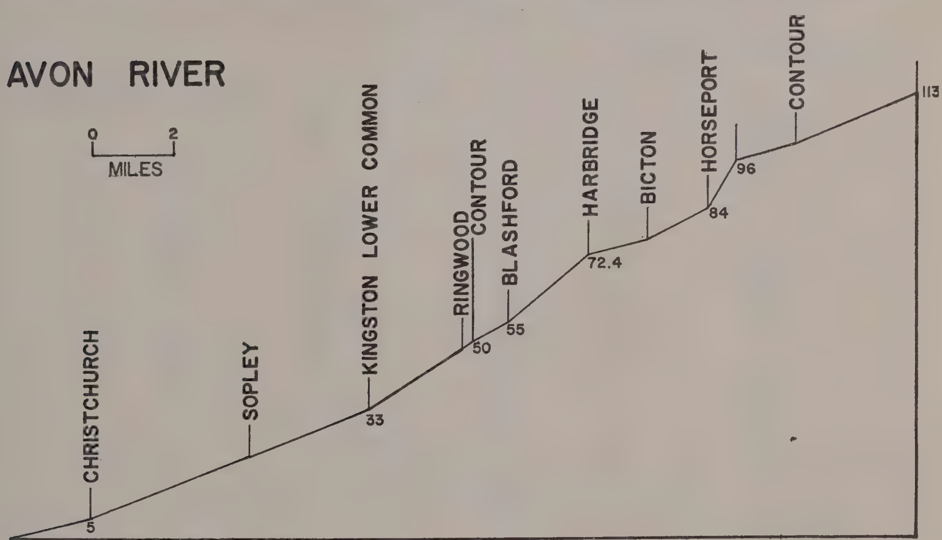


Figure 11 Longitudinal profile of the Avon River.

succeeded by aggradation to about 50 feet in the Lymington and Beaulieu Rivers. The corresponding aggradation occurs at 55 feet in the Avon. The alluviations are followed by knickpoints at 37 feet in the Lymington, 39–42 feet in the Beaulieu, and 48 feet in the Avon. These are in turn succeeded by aggradations at 15 feet in the Lymington, 13 feet in the Beaulieu, and 33 feet in the Avon. Possible knickpoints occur at 9 feet in the Lymington and at 21 feet in the Avon.

Since the sequence is repeated in the streams studied, the following correlations seem reasonably good. In each of the valleys there is an aggradation near 50 feet, which may equate with the 35-foot terrace via the intermediate delta with its present edge near 40 feet. Therefore the knickpoint which pre-

cedes this aggradation and is near 75 feet must correspond to the regional time resulting from the aggradation of the 70- and 35-foot stages. In the same way, the knickpoint which varies from 37 to near 50 feet (in the Avon) must equate with a low sea level recurring between the times of 35 foot terrace and the 15-foot delta. No knickpoint for the interval between the 100-foot stage and the 70-foot terrace can really be expected if this is the time of origin of the Lymington (and Beaulieu) River, since it would have been this phase of retrogressive erosion which established the river. The presence of a knickpoint at 96 feet in the Avon River fits with the existence of much older terraces along its flanks.

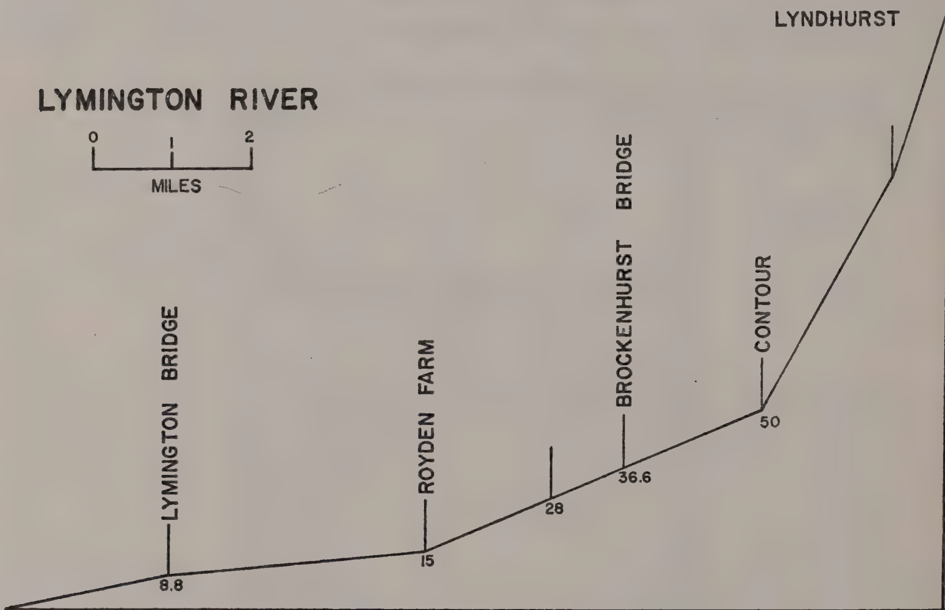


Figure 12 Longitudinal profile of the Lymington River

Estimates for the knickpoints and the aggradations are probably somewhat high as given, because the spot heights are not uniformly on the inner edge of the floodplain, and the contours would tend to magnify this error. The margin of error is suggested by Green's statement[28] that a knickpoint appeared at 60 feet in the Avon, Test, and Stour, among others. Presumably this 60-foot knickpoint was obtained from field mapping, though the uniformity of height in a number of rivers is rather striking. Nonetheless, if allowance is made for a margin of error, the suggested correlation with the terraces is probably correct.

The term 'delta' as used is not conventional. On the other hand, there has been the problem of identifying, by a term, the relationship of aggradation

[28] J. F. N. Green, 'The Age of the Raised Beaches of South Britain', *Proc. Geol. Ass.* 54 (1943) 129–140.

and erosion at the junction of a minor tributary with a major stream which is itself adjusted to changes of sea level. Indirectly, therefore, the mouth of the Lymington adjusted to changes in sea level and would have had a delta-like aggradation with the exception that there might be little foresetting of the beds. The lower edge of this ‘delta’ might tend also to be somewhat higher than the edge of the Solent River.

The Buried Channel of the Early Glaciation

This channel is in no way an obvious one, and the proof of its character will depend ultimately upon more than is presented here. There are, however, several points worth recording. This channel belongs to the Solent River and not to the present day streams which flow in various portions of it.

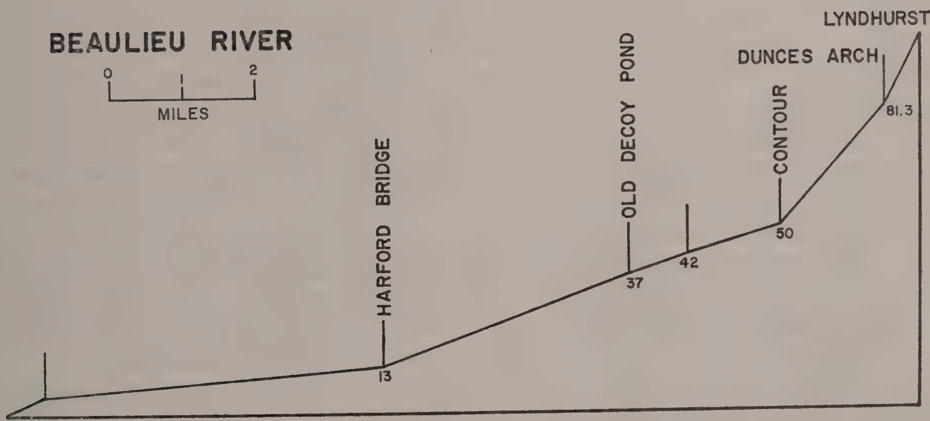


Figure 13 Longitudinal profile of the Beaulieu River.

Reference to Figure 2 will show a cross-section of the channel, with its north wall sloping steeply from the 300-foot terrace down for over 200 feet, its south wall climbing out over 100 feet to the surface of the 200-foot terrace. It may be at once argued that this is simply the result of the excavations of the Oberwater and Blackwater Rivers at a later date, coupled with minor lateral erosion. This in fact is true, to the extent that they have followed the ancient channel in their headward movement.

The first point to be considered is that the Blackwater and Oberwater flow in a direction different from other streams in the New Forest. Their trend is easterly and remarkably straight, and the Lymington River itself flows in this direction after it has been joined by the two streams. It then turns abruptly south to the present Solent. Further to the east, the Bartley maintains this trend as it flows to Southampton Water at Totton. The interesting thing about this

trend is that it parallels the disposition of the terrace remnants of the 300-foot stage, suggesting that it is the course of the Solent following an aggradation in that position. Note also the extraordinarily straight gradient of the Oberwater. It is likely that the Oberwater and Blackwater were captured by the Lymington following the 100-foot stage.

A second point is that the highest aggradation in the Lymington and Beaulieu Rivers is approximately 50 feet, yet there are disconnected patches of alluvium *and peat* in the upper reaches of the Blackwater and Oberwater, several miles above this aggradation at about 50 feet. These segments of alluviation thus may be remnants of an earlier aggradation in the area, presumably that of the 230-foot stage as it succeeded the low channel level.

A third factor is the presence of the terrace remnant at 285 feet in the Avon valley just west of Picket Post. This remnant has no parallel in the Solent and was probably destroyed by the downcutting which caused the channel. There is, in fact, on the large plain extending west from Burley, room for another feature between the 200- and 230-foot terraces and the 300-foot terrace. There is, however, no such feature, and it is best explained by a channel cutting which succeeded the 285-foot remnant, obliterating it in the Solent drainage valley. Since this terrace does not exist, elsewhere in the Solent, it has been necessary to guess that it may have graded to about 260 feet, using other fluvial terraces as a comparison.

This channel must thus have followed the aggradation of the 300-foot terrace and possibly also the 285-foot remnant preserved in the Avon Valley. That it preceded the formation of the 230-foot terrace is shown by the bevel of that stage which is cut into the cliff topped by the 300-foot terrace.

The identification of this channel as Early Glaciation in age depends upon the altimetric association of the 230- and 185-foot terraces with the Milazzian sea level. Since it is considered as preceding those terraces, it must also precede the high sea level of that time.

Climate and Chronology

The establishment of a relative chronology depends in part on establishment of the climate at any given time, and we are, in effect, concerned with a relative climatic sequence. For several reasons, this chronology lacks strength. Partly it is lack of data due to insufficient time and money; partly it is because the data are often difficult to find, let alone interpret once recognized. When incomplete, such data and their interpretations appear straightforward. This is of considerable importance here because I have taken issue with Everard's interpretation of the terraces. It is fundamental to proper climatic and chronological interpretations to know whether these terraces are fluviatile or marine. It is my contention that all of the terraces beginning with the 300-foot stage are fluviatile, whereas Everard maintains that some are marine. It is possible that those at 236 and 355 feet are also fluviatile.

The key to the interpretation of the Solent terraces as fluvial lies in the 100-foot stage as described. The important point is that the fall of the bench is paralleled by the slopes of the surface from Mount Pleasant to Blackfield. This suggests straightway a climatic rather than a thalassostatic situation.

A terrace of the latter kind, adjusted to changes in sea level, would have shown a bench diverging steeply away from, rather than parallel to, the surface of the terrace. The stratigraphy, however, permits another insight. At Blackfield, the final aggradation of gravel is horizontally bedded and is gravel only. At Mount Pleasant, the final aggradation is in an alternating sequence of gravel and loam. This suggests that it is in the head of a tidal reach where the gradient is diminished but not obliterated by adjustments to changing sea level. It is in effect, still above the point where the bench falls with a greater slope than the surface. The terrace is probably, therefore, of thalassostatic character at Blackfield and in the transition zone at Mount Pleasant. This interpretation is supported by a section at Milton, west of Blackfield, where the stratigraphy is the same, but the total thickness is about 16 instead of 20 feet.

Everard's misinterpretation of the 100-foot stage as marine was the result of including the Lymington delta sediments with the Blackfield gravels. This was possible because he was measuring surfaces only, not the benches or examining the stratigraphy, and the disconnected nature of the terrace remnants, coupled with solifluction, confuses the issue. There can be no mistake about the fluviatile character of the 100-foot stage, not just because of the gradient and stratigraphy, but also because both banks of the river's bench are visible in section: the left bank at the Boldre pit and the right bank at Blackfield II.

If a north–south line were to be drawn just west of the Lymington River it would probably be close to indicating the transition from thalassostatic to climatic terraces. So far as I know, there is at the moment no way of estimating the tidal range of the fluviatile Solent River, i.e. where it entered the sea. The tidal ranges along the present Solent are of no value, and it will be necessary to know more of the position of the mouth of the former river during high sea levels. On a river the size of the Solent it is impossible to determine, without much more information, how far up the river the effects of the tide were registered. Because of the 100-foot terrace, the upper limit is tentatively considered as having fluctuated between Milton and Lymington.

It has already been suggested that the position of the high terraces on the line of mean sea fall is indicative of the constant drop in sea level upon which the fluctuations of glacial eustasy were imposed. One of these (at 355 feet near the Compton Arms, Stoney Cross) may belong to the Late Tertiary, consequent, Test River. It precedes those at 326 and 300 feet (actually, *c*. 308–314 on the flank of the Avon Valley), the latter of which is certainly fluviatile, the former possibly so. These two belong to the Solent, and in their present position, are probably climatic. If so, no glacial fluctuations are needed to explain their

aggradation, and it is noteworthy that the gravels of the 300-foot terrace are a uniform deposit comparable to that in the 355-foot stage. They are, however, much better sorted. It is also noteworthy that no climatic division is recognizable in the stratigraphic sequence. The bedding at the 326-foot Newtown pit is probably best explained as current bedding; it is certainly not deltaic or estuarine. As yet the 285-foot segment has not been examined, so that no appraisal of its stratigraphy is possible. Its position indicates a fluviatile character.

If the gravels at 355 feet are part of the Tertiary Test River, then the terrace remnants at 370 feet (including the minor strandline at 365 feet) and above must also be Tertiary. This segment cannot be put to later Pleistocene river action because any adjustment to a later sea level (and it would necessarily be a low sea level) would mean an almost impossible gradient of at least 30 feet per mile. It must, therefore, be of Tertiary age. Its fluviatile character, however, is at present dependent upon its position in relation to the higher terraces at 370, 390, and 420 feet, and this requires further examination.

Everard regards those higher terraces as marine, but the possibility of their being deltaic or estuarine needs further study, i.e. whether they may be taken as part of a Tertiary Avon River system.

The importance of the high terraces is that they show no climatic division in the accumulation of sediments, such as is present in the low terraces. This, when coupled with the spacing of the major still-stands (if the higher terraces above 355 feet are marine) suggests a retreat of the sea. The cause of the halts cannot be explained by local circumstances since the more or less uniform drop in sea level was presumably world-wide. My argument is only that these halts were not caused by glacial eustasy. In short, a relatively uniform climate is inferred, of an interglacial or postglacial nature, and, with respect to the New Forest at least, preglacial in time.

The first major climatic fluctuation appears subsequent to the 300-foot terrace, in the buried channel which separates the 230-foot stage from all of the high terraces. This must represent a major cold interval and a sharply lowered sea level. It is the first major erosional feature.

The next major climatic fluctuation involves the aggradation of the 230-foot stage and the 185-foot stage. Those sea levels, estimated by Everard, correspond to the Milazzian altimetric division, which is equated with the Antepenultimate Interglacial.[29] The stratigraphic section (Fig. 3) makes it clear that a minor cold interval occurred between the aggradation of the 230- and 185-foot terraces. Of the sections available in the latter terrace, that at Long Slade Bottom I is most interesting. Here it is possible to see the nature of accumulation of the sediments, since on both flanks of the section, the 'loam' is a good deal sandier than in the centre, where it is siltier, reflecting thereby

[29] *op. cit.* fn. 11.

the nature of deposition around the perimeter of the cross-section, though the bench itself is not visible along the edges. In fact, the river was reworking sediments at this point when its flow began to diminish and finally ceased. It is probably a section of a meander.

The only evidence for a cold interval succeeding the fluviatile aggradations and minor cold phase lies in the 175-foot gravel-capped summit near Lyndhurst. As already pointed out it cannot be the result of denudation of the 185-foot stage in that area. Its position, when compared with the 165-foot terrace, as mapped by Everard,[30] makes it clear that it cannot belong to that (or any later) stage of events. It must therefore be the result of a downcutting which followed the aggradation of the 185-foot terrace, and for easier reference, it has been termed the Lyndhurst leaf.

The succeeding terraces at 165 and 150 (130?) should belong, on altimetric grounds, to the Tyrrhenian sea levels and the Great Interglacial. The composite 100-foot terrace (103–105) certainly does. There are no buried channels and no knickpoints in existing river thalwegs to testify to any major cold phase which might have separated them. It has not been possible to examine the stratigraphy of the 150-foot terrace, but it may well be fluviatile and graded to a sea level near 130 feet, judging by the steady diminution in surface height from west to east (150–130 feet, approximately, in 9–10 miles). In any event, these terraces can, on present evidence, only be regarded as separated by minor cold phases, such as separates the 230- and 185-foot terraces. The 100-foot terrace, as already shown, possesses two distinct aggradations, separated by a channel cutting to *c.* 75 feet or below, with the second aggradation separated by an interval in which erosion took place accompanied by weathering of the lower loam. That first aggradation appears to have been to *c.* 91 feet at Blackfield, and is corroborated by the Longdown leaf of this stage in the Test River (see Fig. 8). This is, therefore, ample evidence for cold-warm fluctuations of a minor order, which should not be unexpected in a period as long as the Great Interglacial.[31] Such fluctuations are also represented in the Lower Thames.[32] It should also be remembered that during such a long interval of time, the steady fall of sea level upon which glacial eustasy is superimposed must have continued.

The next cold interval for which there is any evidence succeeds the aggradation of the 100-foot terrace and is represented by a knickpoint at 96 feet in the Avon River and by the initiation of the delta-terrace relationship of the Solent River with the Lymington (and probably also the Beaulieu), which has been described in some detail. The pronounced knickpoint is sufficient to suggest that this was a cold interval of a major order, which preceded the formation of the 70-foot terrace. Later knickpoints, near 75 feet, in the present rivers, are

[30] *op. cit.* fn. 1, fig. 1.
[31] *op. cit.* fn. 4.
[32] F. E. Zeuner, 'Riss or Wurm', *Geologische Rundschau*, Band 4/5 (1954), 98–105.

not so pronounced, as is true also of the knickpoints near 37–42 feet. Whether, however, these indicate a diminution in climatic intensity is most uncertain. It may simply be due to the tendency of the slope to flatten out toward the mouth of a river. In any case, there is a sequence of warm-cold changes involved, with the 70- and 35-foot terraces (60 and 25?) assigned to the Last Interglacial on altimetric grounds, and separated one from the other by a cold interval. It has already been suggested that the 15-foot deltaic remnant is Epi-Monastirian in age.

The presence of the mammoth (*E. primigenius*) teeth in the base of the section of the 15-foot terrace at Nursling is additional evidence for the cold phase which separated this from the 35-foot stage. Since it occurs in a cobble pocket at the very base of the section, it must have been carried in when the Test River first began its rise following a cutting phase, marked here by the bench near present sea level. It suggests, as might be expected, that the early part of the aggradation may have occurred under cold steppe conditions, followed later by warmer climate as the interstadial developed and aggradation proceeded with the rising sea level.

If the Mudeford section (Fig. 10) is part of the 15-foot fluvial terrace of the Avon, the solifluction deposits cut into it indicate that certainly two cold phases succeeded the aggradation. There may even have been three. Since the 15-foot terrace has been assigned to the first interstadial of the Last Glaciation, this would indicate at least two and possibly three succeeding glaciations. It confirms at least three glacial episodes for the Last Glaciation.

The two cold intervals indicated by the two solifluctions at Bransgore and the frost-weathering and solifluction at Boldre, because of the Mudeford section, can only be used to show two cold intervals following the Tyrrhenian aggradations. They may belong to the Last Glaciation.

The climatic sequence may be summarized as follows:

Feature	*Climate*
High Terraces (420–300)	warm
Buried channel (partly occupied by Oberwater River)	cold
230-foot terrace:	warm
185-foot terrace:	cold-warm
Lyndhurst leaf (175 feet)	cold
165-foot terrace:	warm
150-foot terrace:	warm
'100'-foot terrace:	
(a) Aggradation I (91 ft., Blackfield II; and Longdown leaf):	warm, following a cold phase
(b) Channel cutting (75 ft., Blackfield; and Cadnam leaf):	cold
(c) Aggradation II (First part, stops with lower loam):	warm
(d) Erosion surface on lower loam and weathering of lower loam:	cool-moist?
(e) Aggradation II (final, 103–105 ft., Blackfield area):	warm

96-foot knickpoint (Avon River):	cold
80-foot delta (Lymington River)—70-foot terrace:	warm
75-foot knickpoints (Avon, Lymington River):	cold
40-foot delta (Lymington River)—35-foot terrace:	warm
37–42-foot knickpoints:	cold
15-foot delta:	warm
Two solifluctions at Mudeford:	cold

The evidence for the cold phase which precedes the first aggradation in the 100-foot terrace is of course the bench at about 84 feet (Blackfield II) on which it rests.

None of these is sufficient by itself to permit grouping into major glacial and interglacial stages. The answer has already been indicated by the grouping of terraces according to sea level adjustment and the known altimetric divisions. These result in the following correlations:

Feature	*Relative Time*
High Terraces:	Pre-glacial (in New Forest)
Buried Channel:	Early Glaciation
230–185-foot terraces:	Antepenultimate Interglacial
Lyndhurst leaf:	Antepenultimate Interglacial
165-foot and 150-foot terraces:	Great Interglacial?
100-foot terrace:	Great Interglacial
96-foot knickpoint:	Penultimate Glaciation
80-foot delta—70-foot terrace:	Last Interglacial
75-foot knickpoints:	Last Interglacial cold phase
40-foot delta—35-foot terrace:	Last Interglacial
37–42-foot knickpoints:	Last Glaciation 1
15-foot delta:	First Interstadial
Mudeford solifluctions:	Last Glaciation 2, 3

Such a correlation depends upon the relationship of sea levels to Pleistocene events as established beyond the bounds of the New Forest.[33] The identification of glacial periods depends upon the relationship of local periglacial phenomena to local phenomena adjusted, in the form of river terraces, to high interglacial sea levels. This in the New Forest, has depended first upon Everard's study[34] for distribution and surface heights of terrace remnants, and upon the writer's research. This has been concerned primarily with stratigraphic data and their relationship to a number of features not included by Everard. Although the present interpretation would be disrupted by use of Everard's conception of the lower terraces as marine, the data are still available for use. The reconstruction as it stands has many weaknesses, but since the writer will not be returning to the scene, it was felt better to attempt this tentative statement than to leave it unsaid.

[33] *op. cit.* fn. 4 and 11.
[34] *op. cit.* fn. 1.

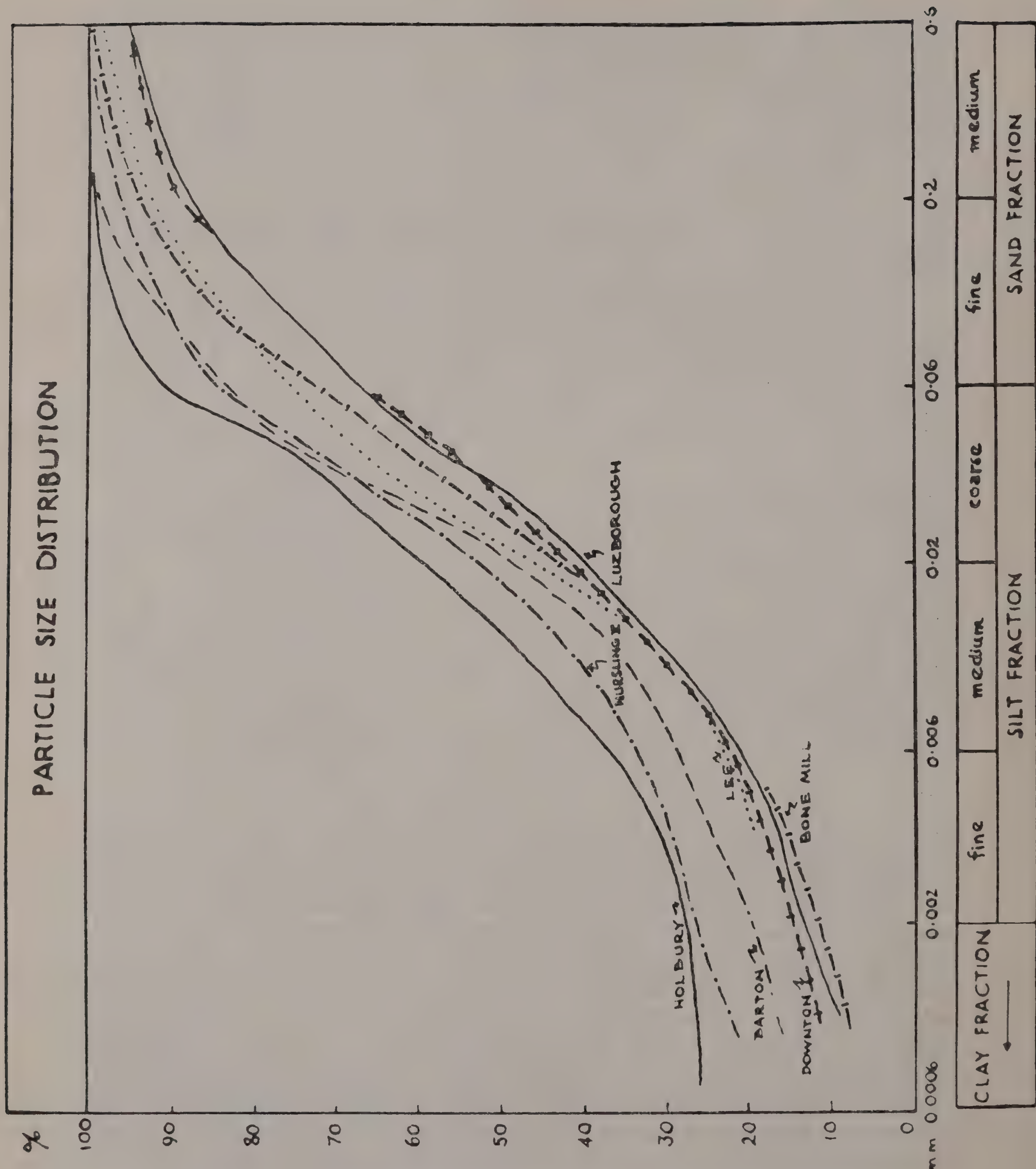


Figure 14 Particle size distributions for the New Forest brickearths.

Brickearths

In Hampshire, the term 'brickearth' is, of course, one used to describe a multitude of different sediments. It was hoped, originally, to give detailed consideration to a definition of it, but this has proved impossible. Laboratory studies have been made of almost all types of brickearths, for most of which there are representative samples in the Institute of Archaeology. It is tempting to regard brickearths, *a priori*, as loesses. There is, however, a number of complications, not the least being that save in two localities, it is never more than three feet thick. This is a suspicious circumstance when a brickearth is situated on the surface of a fluviatile terrace, as most are. If the brickearths were laid down by the wind, they should be more variable in thickness. A second complication lies in the moist oceanic climate of southern England, which is likely to lead to rapid destruction of such loess as might be deposited. The brickearths have been compared with known floodloams, both by mechanical analysis and by microscopic study. They have also been examined with an eye to structure in the field, the presence of manganese, and colour. The mechanical analyses of the brickearths are shown in Figure 14, which reveals a good degree of likeness among the samples. The similarities might be duplicated by either deposition or reposition of silts in the water. Most of the samples exhibit a disturbing amount of sand. However, some of the sand might be saltated material, mixed continually with loess as the latter was deposited from aeolian suspension. Further, the brickearth curves do differ from the known floodloams (Fig. 15). Still, neither the position, the particle size distribution, nor the possibility of saltation and erosion allow identification of the New Forest brickearths as loess.

Where the clay fraction tends to be large, it is possible to account for this by weathering, since none of the brickearths is protected and all have soils formed on them. All are decalcified. These soils are brownearths or podsolic brown earths. In the latter instance they differ from a podsol in the lack of a well-defined leaching horizon (it is, rather, only incipient) and in the absence of a B_h horizon. Further, there is an absence of raw humus, or A_o horizon, reflecting some difference in the nature of the humus structure, though these soils, as at Holbury, may be acid (pH5.04). It is in the study of ferric hydroxide in soils formed on loess that some insight may be gained as to the nature of the New Forest brickearths.

This study of ferric hydroxide depends primarily upon micromorphology, as developed by Kubiena[35] and exploited for archaeological purposes by Dalrymple[36] and Cornwall.[37] Soils formed on loess exhibit a feature known as

[35] W. L. Kubiena, *Micropedology*, State University of Iowa Press, 1938; *Soils of Europe*, Thos. Murby, 1953.

[36] John B. Dalrymple, 'Study of ferruginous horizons in archaeological sections', M.Sc. thesis, University of London (unpublished), 1955.

[37] I. W. Cornwall, *Soils for the Archaeologist*, Phoenix, 1958.

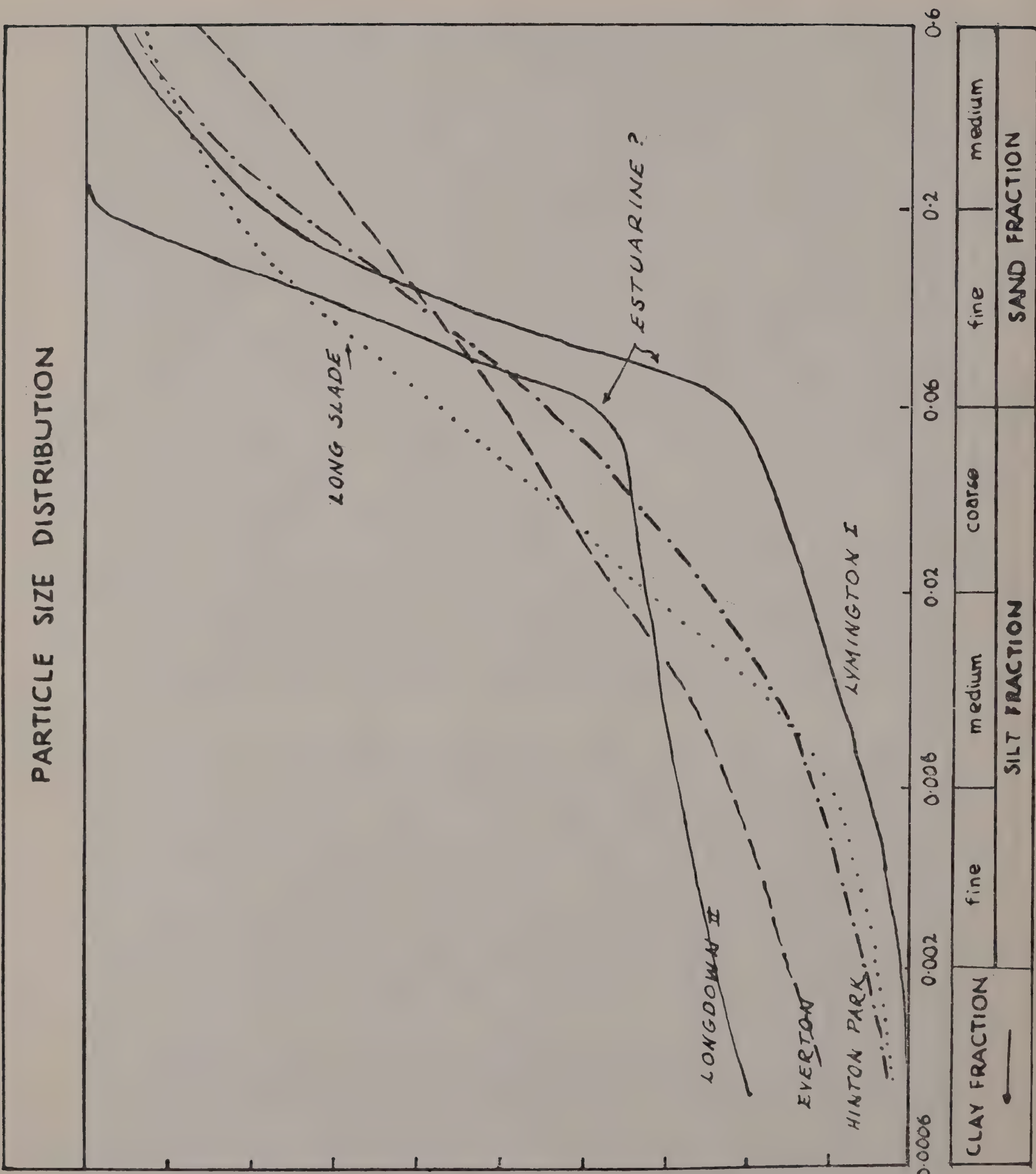


Figure 15 Particle size distributions for the New Forest floodloams.

parabraunerde, physically washed-in mobile iron, not otherwise present in brownearths. After fuller study, it appears that it is possible also to have the iron present in the fresh loess, but evenly distributed. Under weathering it then develops parabraunerde characteristics. There are certain complications, since mobile iron occurs in other soil types, and these must be resolved by examination of the elementary fabric. Parabraunerde soils have a distinct fabric, although a similar feature appears in podsolic braunerde. At first, it was thought that both soils were exhibiting a similar miscroscopic iron structure. However, there is no real identity.

Now, there are two types of elementary soil fabric relevant to consideration of the New Forest brickearths, one normally characteristic of a braunerde or parabraunerde (intertextic), the other of iron podsols or podsolic braunerdes (plectoamictic). These fabrics are defined as follows[38]: *Intertextic*—The mineral grains are in this case uncoated and appear bare. They are connected with each other by intergranular braces or are completely embedded in a porous ground-mass of flocculated colloids. This fabric is, therefore, characterized by the presence of cavities in the ground-mass. *Plectoamictic*—Here the mineral grains are completely embedded in a peptized fabric plasma which not only coats the mineral grains but also forms the intergranular braces. Where there are few skeletal mineral grains, cavities are found in the peptized matrix.

The New Forest brickearths appear to be primarily braunerdes or parabraunerdes, though the colluvial filling of a channel at West Pit, Stoney Cross, exhibits the podsolic characteristics one would expect on the gravel sheets of the area. At Holbury, Nursling Triangle, and Gore, there are sediments exhibiting a true parabraunerde microstructure in a braunerde soil characterized by an intertextic fabric. (Plates II, III and IV). On the other hand, there are sediments at Luzborough, Redbridge Old Bone Mill, and Gore, that are apparent braunerdes with a plectoamictic fabric, which exhibit mobile iron at first easily mistaken for that in a parabraunerde. (Plates I, V and VI). In the former three, there are few iron-humus concretions and coherence depends upon the embedding of the mineral grains in the ground-mass, which is characteristically full of cavities. In the latter three, there are numerous iron-humus concretions and the peptized iron coats the grains and forms intergranular braces. There are relatively few cavities. There are also braunerdes with intertextic fabrics but no parabraunerde microstructure at Barton, Lee (Test River), and Nursling II.

Mechanical analysis of the Holbury brickearth suggests a loess which has been weathered in place, while at Gore (Samples 4, 5; Fig. 16) the sediment is a fine sand probably wind-blown into position and then weathered. The Nursling Triangle brickearth has undergone some washing and movement but is generally in place. The other sediments under consideration could be water-deposited as well as wind-deposited. At Gore (Samples 1–3, Fig. 16) the

[38] *op. cit.* fn. 36, p. 87 above, 67.

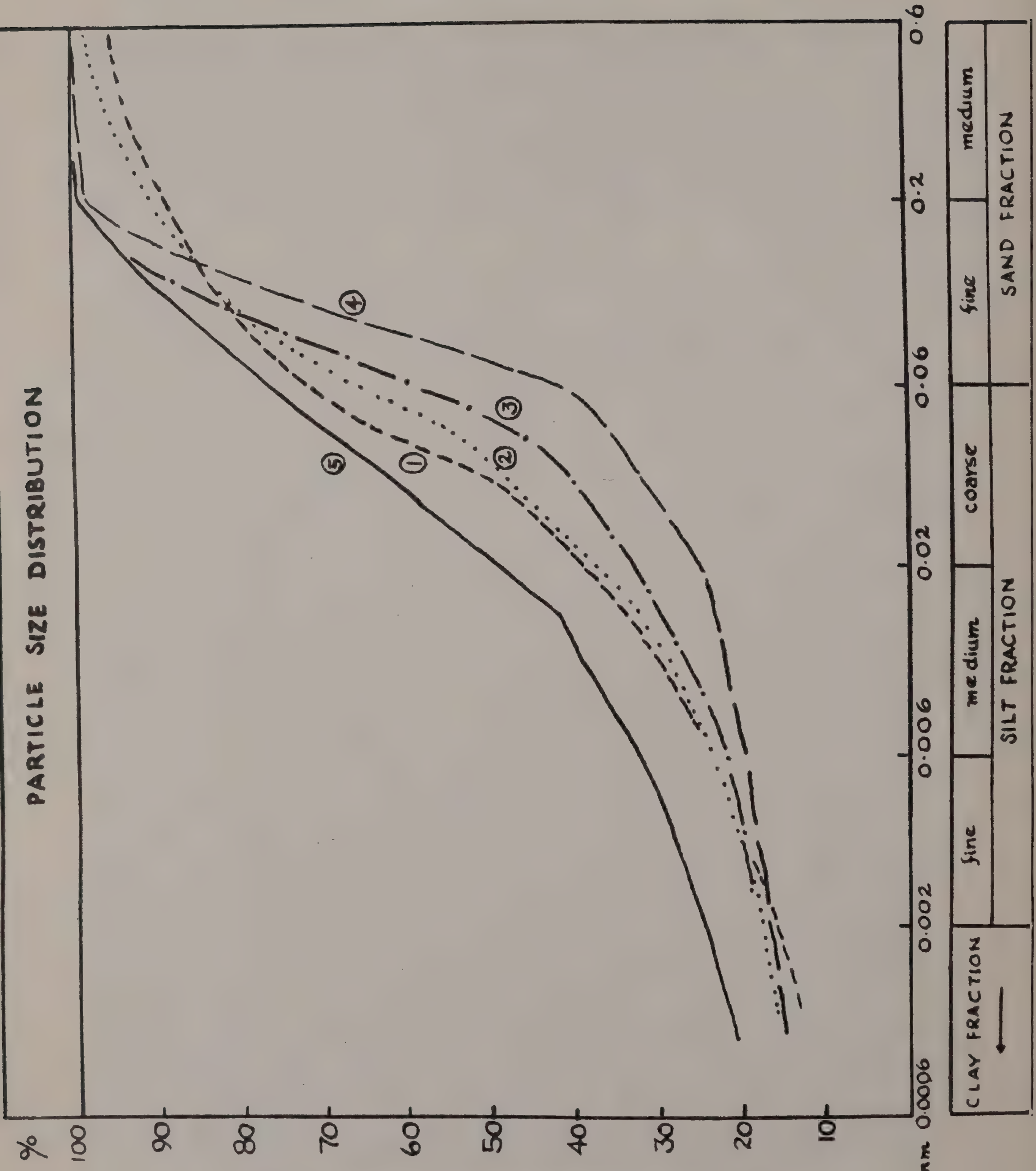


Figure 16 Particle size distributions for the section at Gore.

lower material is flood-loam, as at Luzborough and probably also at the Redbridge Old Bone Mill site.

The true parabraunerde feature is mobile iron present in large quantities around and in cavities and channels, but it does not coat the grains and is not precipitated. In the instances where there is mobile iron which appears to be parabraunerde in character, the iron does not appear concentrated around and in the cavities, though it is seen in channels in some cases. It appears instead to be flowing around and adhering to the mineral grains and has, under high power, a laminated structure. Next to the mineral grain, the iron has been precipitated and is isotropic. Gradually, away from the grain, layers have been built up, and only the outermost layer is mobile. There are also often numerous iron-humus precipitates and concretions throughout the ground-mass. This is a characteristic of podsolization and indicates that it is a podsolic braunerde. The movement of iron appears largely to take place as ferric humate. There is thus a contrast between the two types of mobile iron in that the true parabraunerde feature does not affect the mineral grains, but does fill and line the numerous cavities. In the podsolic braunerde, the reverse is true.

The question arises as to whether the latter instance (podsolic braunerde) is not the same as in parabraunerde. The answer is no. In a fully developed podsol the mobile iron shows similar characteristics, except that it has gone even further and developed a chlamydomorphic fabric wherein the intergranular braces have disappeared and cohesion depends upon the colloid coatings of the grains. This is the type of soil profile and fabric which is characteristic of the undoubted floodloams of the New Forest. The mobile iron has then been largely precipitated into concretions and coatings. The tentative conclusion is that the mobile iron in a plectoamictic fabric represents a developing stage of which the chlamydomophic fabric is the climax. The implication is that soils without the microscopic iron structure of parabraunerde are floodloams. The three instances cited as having intertextic fabric with mobile iron in the cavities are therefore interpreted as loesses. They have been compared with the known loess of St. Pierre les Elbeuf and match in every respect.

There is then a second question as to those brickearths which have an intertextic fabric but no mobile iron and which thus appear to be neither one (loess) nor the other (floodloam). These in fact sometimes show a subsidiary plectoamictic fabric and may thus be developing into podsolic braunerdes. The inference is then that there is a developmental series involved, from parabraunerde and braunerde through podsolic braunerde to podsol. Proof will require more data.

The third question which arises is why should only the loesses exhibit parabraunerde soil. I suggest that this is due to the originally calcareous nature of the loess, and a soil formed on calcareous fresh loess will be a braunerde.

Soils formed on floodloams, depending on the size-grading, will have either less in the way of bases to leach or weather-out, or even none at all in a very sandy loam. Further, loess is less and floodloam more permeable so that leaching is simpler in the second type of sediment. In the oceanic climate of southern England, they will tend, therefore, to develop more rapidly as podsolic braunerdes and/or podsols. In the podsolic braunerdes the iron is mobilized by the humus, in the same way as, but less strongly than, in a podsol. If the mobile iron which characterizes parabraunerde is genuinely washed-in by physical means, it is not only a contradiction of the soil type, but demands an explanation of where the iron originally came from. Some of the iron may be mobilized by humus, but this too is *sensu strictu* a contradiction. It might be mobilized by silica gel, at least in the early stages. This remains open to question. Nonetheless, it seems clear that parabraunerde features are characteristic of soils formed on loess, and not of those where podsolization is well under way. The appearance of iron mobilized as a ferric humate results in different distribution of the iron and in a different soil fabric. In this sense, parabraunerde, used with other characteristics, may indicate a loess, while the mobile iron of a podsolic braunerde may indicate a floodloam.

It seems likely that only the brickearths at Holbury, Nursling Triangle, and the upper part at Gore, are weathered loess. At Holbury, this loess rests on gravel which may be part of the 100-foot terrace, so that it can be no older than the Penultimate Glaciation. It compares closely with Older Loess from St. Pierre les Elbeuf, weathered during the Last Interglacial. This, though, is problematical, and the lower time limit is uncertain. The Nursling Triangle loess is duned at the back of the 35-foot terrace and there has been some washing-in action. At 15 inches it shows some podsolic characters which may be the result of this washing-in. When the rest of the 10-foot (or more) section is made available, it may be possible to say more of this material. All that is certain now is that it must be a Younger Loess, possibly weathered during the first interstadial of the Last Glaciation. It compares very closely indeed with a Wurm 1/2 weathering from St. Pierre les Elbeuf.

The section at Gore is interesting because the loess rests upon the weathered surface of the floodloam of the 100-foot terrace. The most important question is when the weathering of the floodloam took place, since the aggradation of this terrace was followed by a cold interval, the Penultimate Glaciation. This weathering may have occurred during an interstadial of the Penultimate Glaciation or during the Last Interglacial. There is no definite way of determining, but the fact that the weathering extends clear down through the floodloam suggests that it took place during the Last Interglacial. The humus horizon is as thick as the postglacial humus on the loess above, and some of this may be missing. It is most likely then that this is a Last Interglacial weathering of the floodloam. If so, then the loess above is Younger Loess, with this distinction

—that it may be locally derived, whereas the loess at Holbury, for instance, may have come from considerably farther afield. Whether it is Younger Loess 1, 2, or 3 is quite uncertain, and weathering of a possible interstadial character is completely masked by the postglacial soil now on its surface.

The Archaeology

Relatively few implements have been found associated with the Pleistocene deposits of the New Forest. Some exist in the collection of the Cambridge Museum, but their provenance is so inexactly known as to be of no use. Four implements, now at the British Museum, are, however, of crucial importance to the geochronology of the New Forest.

In 1910 or 1911, three Acheulian handaxes were found in the gravels of Stoney Cross, which comprise a 355 (?) foot Tertiary terrace of the Test River. In 1913, in the 300-foot terrace, at Vereley Hill, an Acheulian limande was recovered. All of these implements have been described and illustrated and they appear to belong properly to the gravels concerned. Both of these terraces antedate the Early Glaciation and the implements are, therefore, typologically too late to belong to these gravels. On the face of it, either the typological and chronological data available for Acheulian implements are incorrect, or the chronology not only of the New Forest terraces, but of eustatic terraces anywhere, is thrown in doubt.

The implements from Stoney Cross are typologically either early Acheulian, or Abbevillian, while the limande from Vereley Hill is an excellent example of Middle Acheulian work.[39] It is possible, therefore, that they were deposited at separate intervals of time.

It is possible to account for the presence of these tools if one resorts to isostatic movement and uplift of the terraces. As Everard has pointed out, however, there is no evidence of tectonic movement anywhere subsequent to the formation of the New Forest terraces, from the 420-foot stage on down. This is based not only on the opposing trends of the terraces (Avon, Solent, Test), but on their agreement with eustatic sea levels determined in many other places. This agreement cannot be accidental or coincidental.

A second explanation might be that these two of the high terraces are in reality later Pleistocene terraces graded to a low sea level. This does not fit with the demonstrated sequence of terraces over the wide area of the Solent drainage system. Further, as I have pointed out with regard to the 355-foot terrace, the gradients involved would be impossible without introduction of severe faulting as a contemporary feature of a lowered sea level. For this, there is no evidence. Again, the sequence of New Forest terraces is so complete for the Pleistocene period that there can be no inclusion of the 355- and 300-foot stages.

[39] *op. cit.* fn. 7. p. 60 above.

A third possibility, that the typology of the Paleolithic is completely 'out-of-joint' cannot even be considered with only four specimens.

The probable answer lies, in fact, in a not unexpected direction. At both Stoney Cross and Vereley Hill, the terraces are dissected by channels which were subsequently filled with colluvial sediments. The Stony Cross channels have been examined in detail, but the Vereley Hill channel is difficult to examine because the pit is flooded with water at the present time. The one soil sample from Vereley Hill agrees with those from Stony Cross when examined under the microscope, as to weathering and composition. Without a series of samples, it is difficult to be sure whether the Vereley Hill channel is contemporary with those at Stoney Cross.

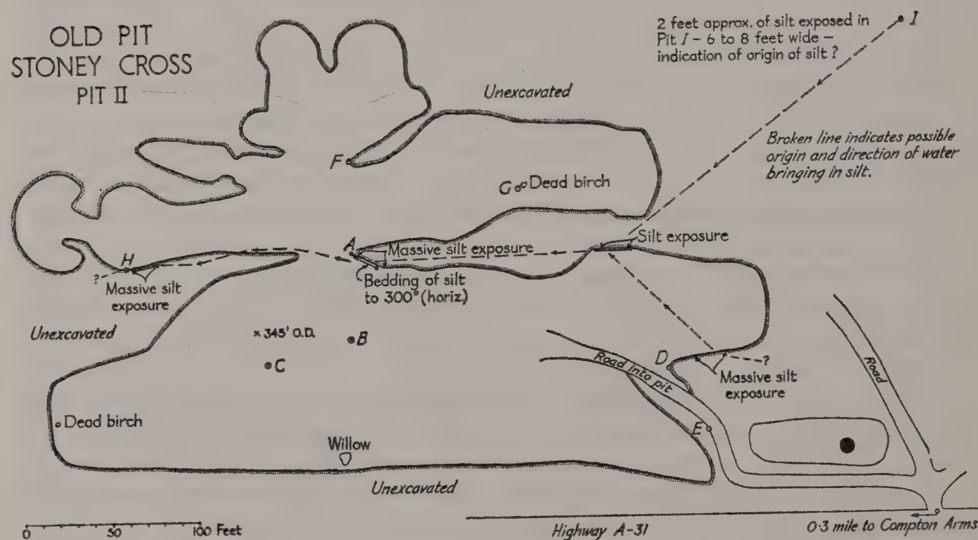


Figure 17 Map of the Old Pit at Stoney Cross

These channels are cut down into the gravel from the then surface of the terrace. Since these were minor stream wanderings across the surface at a high elevation, they cannot be regarded as adjusted in any way to changes of sea level. They are instead a climatic phenomenon and must, therefore, be interglacial in origin. The filling should then have occurred during the onset of a glacial period. If the channels at the two sites are contemporary, they can be no earlier than the Antepenultimate Interglacial, since the 300-foot stage is followed

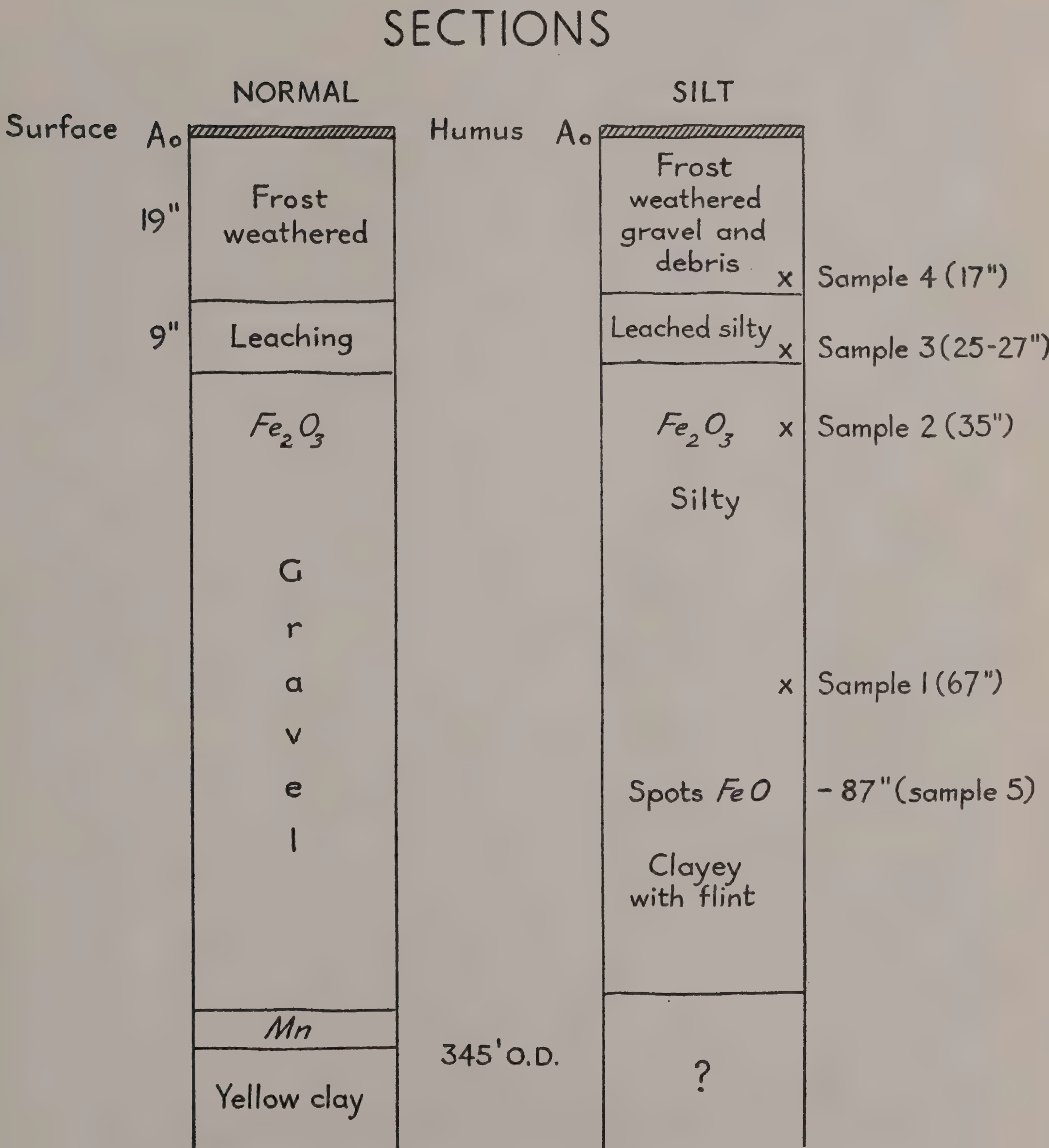


Figure 18 Sections from the Old Pit at Stoney Cross.

by the 'buried' channel of the Solent River which is here equated with the Early Glaciation. That is, they might be contemporary with, but no earlier than, the 230-foot stage of the Solent River.

The channels at Stoney Cross have been mapped in the West Pit (Fig. 17) and partially traced into the East Pit. There are at least two, and possibly three, solifluctions capping the colluvial channel filling (Fig. 18). The soil profile developed on the colluvial sediments is a podsolic braunerde which, micromorphologically, shows heavy weathering. This is substantiated by the fact that a weathering profile has developed in which the clay fraction increases downward through the profile (Fig. 19). Interpretation of the microscopic characteristics is complicated by the fact that this is derived material, with the state of the iron suggesting the incorporation of Tertiary 'clay-with-flints' sediments. There is also a consistent increase in the percentage of heavy minerals downward in the profile, which may be due partly to weathering. Partly also it may be because as the channel filled, the Tertiary sediments into which it cut, at the base of the terrace, were no longer available for fresh transport.

Precise definition of the lower time limit in which these channels could have been formed can be obtained by channels found and compared in the low terraces. No others have been seen to date, but it has not been feasible to examine all of the numerous gravel pits in the New Forest, many of which are disused and need some searching out. The depth and size of these channels (8–10 feet deep) suggest that they may have occurred during the great length of time offered by the Great Interglacial period. Given the discovery of any more channels, it should be possible to demonstrate beyond cavil their contemporaneity and their lower time limit. The suggested upper time limit of the Antepenultimate Interglacial seems sound for the moment.

The implication of this is obvious, that early man camped along the little streams running across the older terraces of the Solent River when that river itself was flowing at a lower altitude, and that he left by accident or otherwise, some of his tools. These became incorporated in the stream deposits near the point of contact between gravel and loam. They could have been found quite confidently in 'sandy gravel' which was not the *in situ* gravel of the old terrace, but the redeposited gravel of the Pleistocene channel. Such streams would probably have been better camp sites than the floodplain of the lower course of a major river like the Solent. This, in any event, is one explanation for the occurrence of these implements in two of the high terraces of the New Forest.

One handaxe from the Luzborough pit in the 100-foot terrace of the Test River just south of Romsey has been given to me (Fig. 20). This was found out of place by Mr. Foot, a workman for the gravel company, and he has graciously turned it over to the Institute of Archaeology. The flaking is flat and well executed on one face, but on the opposite face at one edge there is a series of step flakes. The shape and condition of the implement suggest that

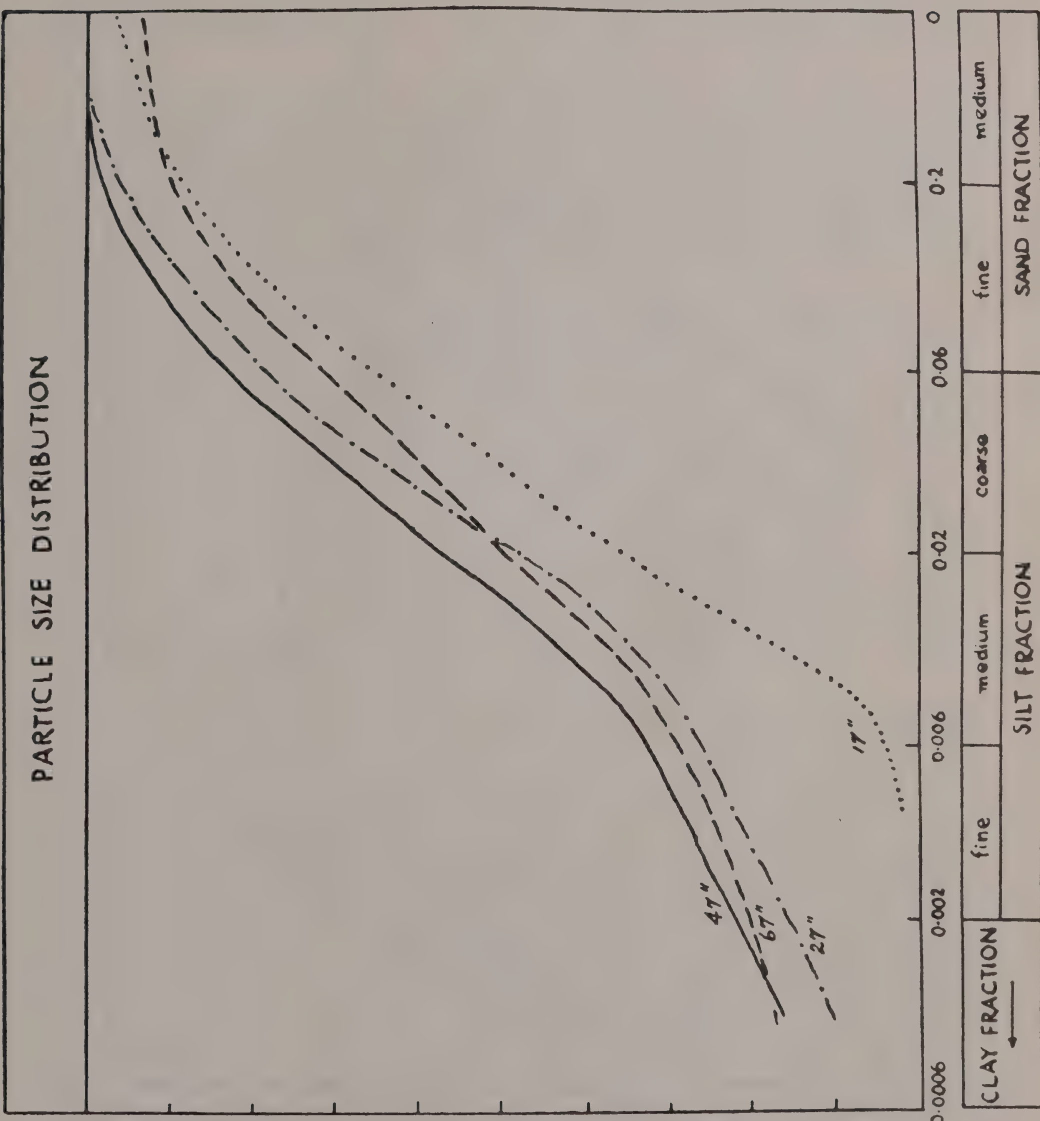


Figure 19 Clay weathering profile from the channel in the Old Pit at Stoney Cross.

Figure 20 Hand-axe from the 100 foot terrace at Luzborough. (half actual size)

only the convex edge was used. This edge is straight in cross-section and shows considerable battering, which is lacking from the edge with the step flaking. Typologically it is Middle Acheulian, which corresponds with its derivation from the 100-foot terrace.

Conclusions

Because the data are incomplete I have not undertaken to relate the New Forest sequence to chronologies of river terraces elsewhere. That this should eventually be done is obvious, though the pitfalls are perhaps not so obvious. To compare the Solent terraces in detail with those of the better-known Thames, for example, would be wishful thinking at this stage. Too much remains to be done in the New Forest.

Several reasons have now appeared which suggest that the Solent River flowed during all the Interglacials in the New Forest and that it was not, as Everard contends, supplanted by marine beaches. The most important terrace is the so-called 100-foot stage, with its various fluctuations. The sequence of events has a marked resemblance to that at Swanscombe, in the Barnfield pit, with this essential difference: the deposits in the New Forest terrace are of only half the thickness of those at Barnfield. In the latter instance the terrace is clearly thalassostatic; in the former instance, the terrace is probably also thalassostatic, but in or near the transition zone where climatic terraces interfigure with the thalassostatic. It seems likely that this situation also applies to all the other terrace remnants preserved in the central and eastern portions of the New Forest. In the future, therefore, they need to be most carefully examined, with numerous heights obtained for the benches.

Almost all of the conclusions must be regarded as bases for further work. The most important are as follows: That the high terraces are pre-glacial and reflect only a steady lowering of sea level, upon which the later Pleistocene fluctuations were superimposed. Secondly, that all of the low terraces are fluviatile in origin and character. Thirdly, that the Lymington River has its origin (and probably the Beaulieu also) following the 100-foot aggradation and that thereafter it adds a complicating factor, the formation of 'deltas' in conjunction with the Solent River terraces. Fourthly, it seems that the Oberwater, Blackwater, Lymington, and Bartley Rivers have some parts of their courses in a buried channel of the Solent River, formed during the Early Glaciation. Fifth, only one of the brickearths, at Holbury, is likely to be a genuine loess, with a further possible example at Nursling Triangle. The loessic material at Gore is probably a periglacial phenomenon which can be treated as a loess provided that its local origin is recognized. The final conclusion is that the implements from Stoney Cross and Vereley Hill were incorporated in those high terraces at a time subsequent to their formation, probably the Great Interglacial, but are certainly no older than the Antepenultimate Interglacial.

More specifically, the 150-foot terrace needs to be mapped in terms of its bench, which will probably show it as fluvial and graded to a sea level near 130 feet. It may also be that examination of the gravel sheet near Hythe will result in its inclusion in the 35-foot stage and a revision of that presumed sea level to a height nearer 25 feet. Finally, the 70-foot terrace, in my estimation, will also prove fluviatile, with a sea level adjustment to about 60 feet. These conclusions are speculative as yet, but the surface heights alone cannot be used to correlate terraces accurately with Pleistocene eustatic fluctuations of the sea.

Certainly the New Forest terraces of the Solent River and its Test and Avon River tributaries offer a sequence of remarkable completeness. This alone should be a challenge to their further study.

ACKNOWLEDGMENTS

I am deeply indebted to the late Frederick E. Zeuner for his direction of my work on this reconnaissance project carried out 1955–1966; to Ian W. Cornwall for his criticism, his preparation of the photomicrographs, and for his care in assembling this paper for me.

BIBLIOGRAPHY

Chatwin, C. P., *The Hampshire Basin and Adjoining Areas*, British Regional Geology, Department of Scientific and Industrial Research. HM Stationery Office, London, 1936.

Crawford, O. G. S., 'The Antiquity of Man in Hampshire I. The New Forest,' *Papers and Proceedings of the Hampshire Field Club and Archaeological Society*, Vol. IX, pp. 173–178, Southampton, 1922.

Cornwall, Ian W., *Soils for the Archaeologist*, Phoenix House Ltd., London, 1958.

Dalrymple, John B., 'The Study of Ferruginous Horizons in Archaeological Deposits,' *Proceedings of the Hampshire Basin Field Club and Archaeological Society*, Vol. XVIII, Part 3, pp. 263–285, 1954.

'The Solent River:' A Geomorphological Study,' *Transactions and Papers of the Institute of British Geographers*, Publication No. 20, pp. 41–58. 1954a.

Green, J. F. N., 'The Age of the Raised Beaches of South Britain,' *Proceedings of the Geologists Association*, Vol. 54, pp. 129–140, London, 1943.

Kubiena, W. L., *Micropedology*, State University of Iowa Press, Ames, 1938.

Soils of Europe, Thomas Murby and Son, Ltd., London, 1953.

Smith, Reginald A., 'Prehistoric Problems in Geology,' *Proceedings of the Geologists Association*, Vol. 26, pp. 1–20, London, 1915.

Wooldridge, S. W. and D. L. Linton, *Structure, Surface, and Drainage in South-East England*. The London Geographical Institute, 1955.

Zeuner, Frederick E., *The Pleistocene Period*, The Ray Society, London, 1945.

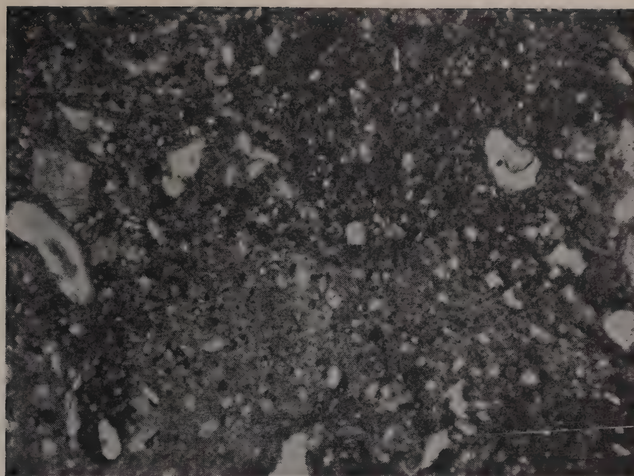
'Pleistocene Shore Lines,' *Geologische Rundschau*, Band 40, Heft 1, pp. 39–50, 1952.

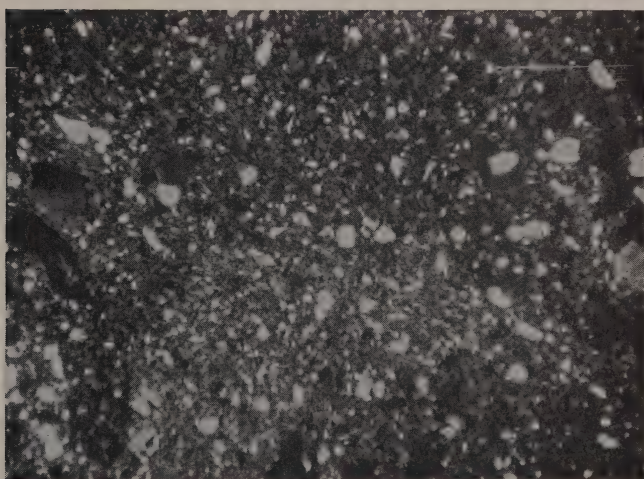
Dating the Past, Third Edition, Methuen and Co., Ltd., London, 1952a.

'The Chronology of the Mousterian at Gorham's Cave, Gibraltar,' *Proceedings of the Prehistoric Society*, Vol. XIX, Pt. 2, pp. 180–188, 1953.

'Riss or Wurm?', *Geologische Rundschau*, Band 4/5, pp. 98–105, 1954.

PLATE I



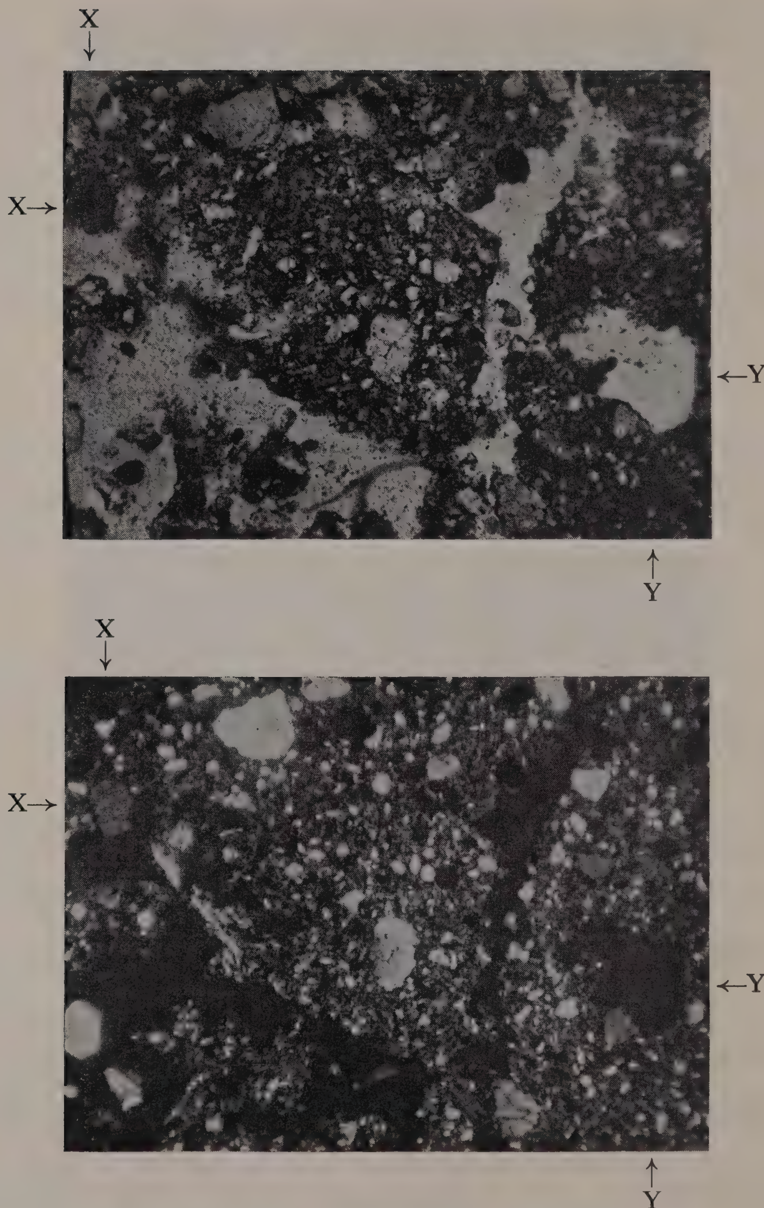


1, 2. Gore No. 5. Dark areas are of interstitial orange-coloured clay/iron colloids, which are also seen lining root-holes and fissures.

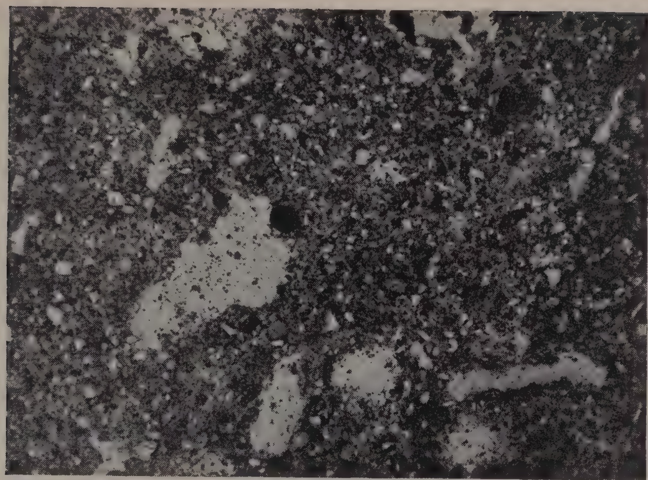
Note on plates:

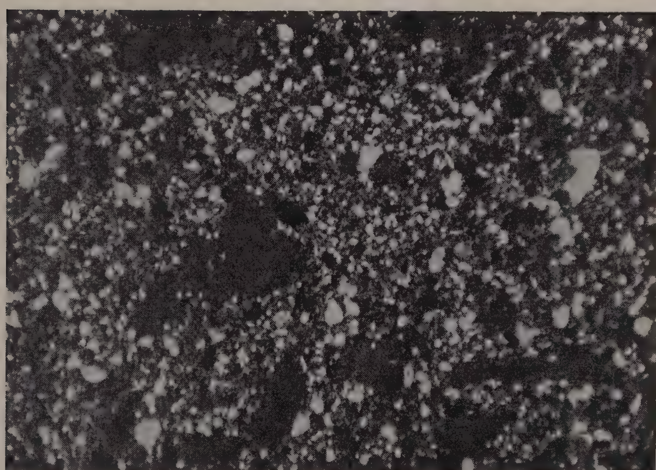
The blocks are at a magnification of exactly x25. Odd figure numbers are photographed in plane-polarized light, the even numbers corresponding under crossed polars. The intersections of arrows marked in the margins show the positions of features referred to A single arrow, only, is used to show a feature cut by the edge of the bloch.

PLATE II

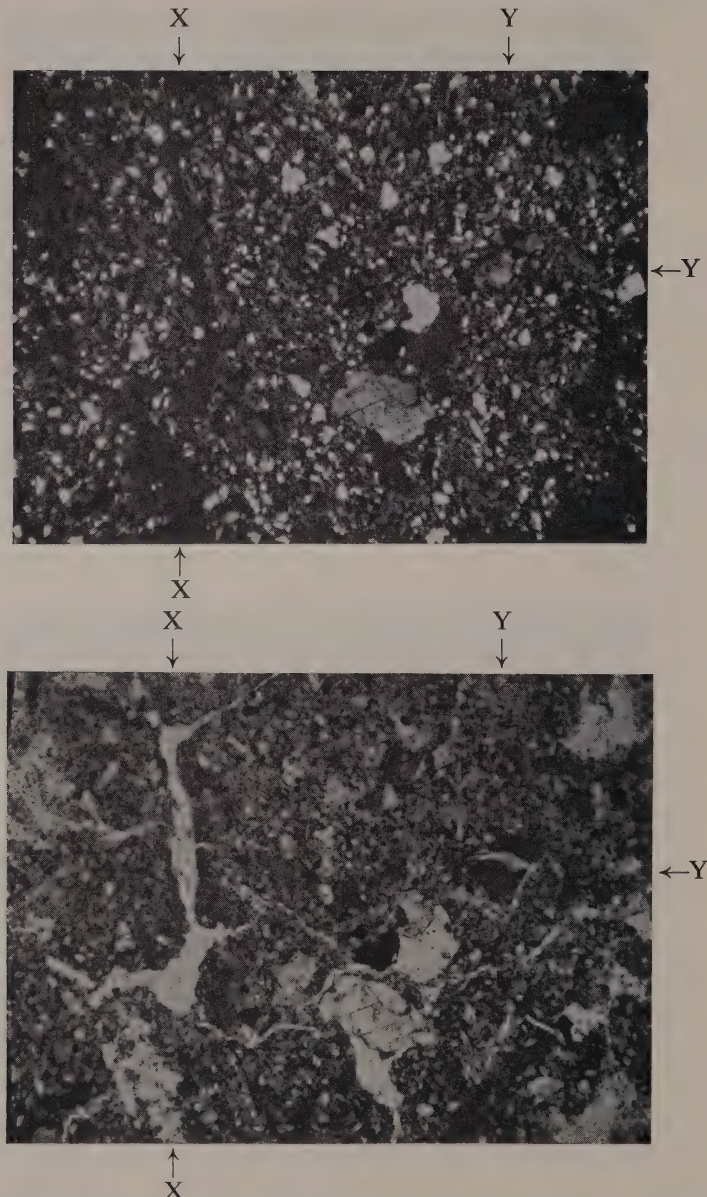


1, 2. **Gore, No. 1.** "X" marks a greenish-yellow grain of glauconite. The diagonal streak (dark in No. 1, light in No. 2) consists of colloids, of which there is some concentration in the fabric round the hole ("Y") at the other end of the field.



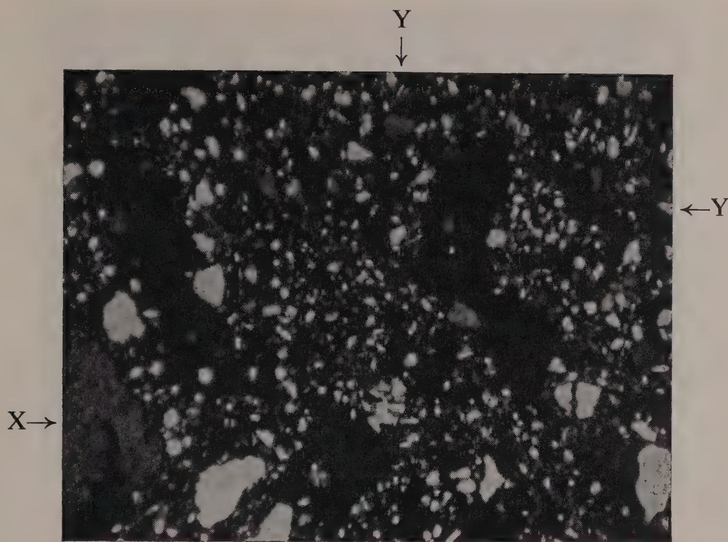


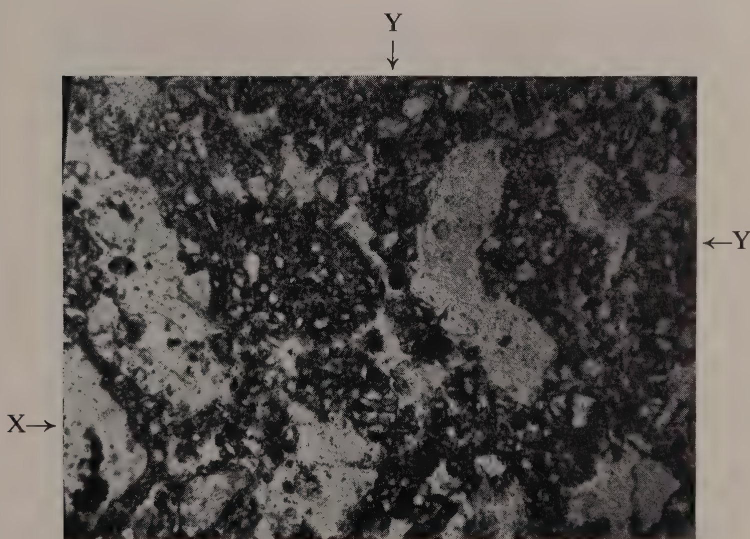
1, 2. Holbury brickearth. The colloids are not readily seen at this magnification. At x100, they are seen to be irregularly distributed throughout the fabric. The general lightness of the fabric in No. 2 is partly due to the widespread anisotropy of the finest matrix, which shows as a marked yellow colour to the eye.



1, 2. Nursling brickearth. Orange colloids line the big fissures, X-X. The dark triangular body (Y) is a mass of the same, once filling a hole completely but now with a shrinkage-fissure crossing it. It is characteristicially "egg-yellow" (Kubiena) under crossed polars. There are many smaller masses like it in the fabric, which are not clearly seen in monochrome.

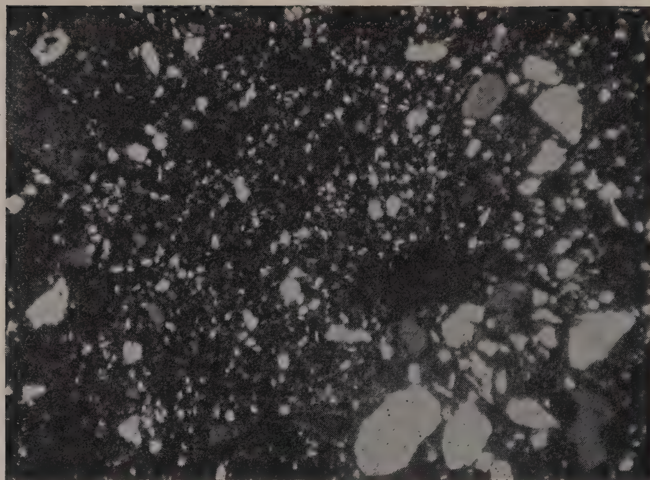
PLATE V

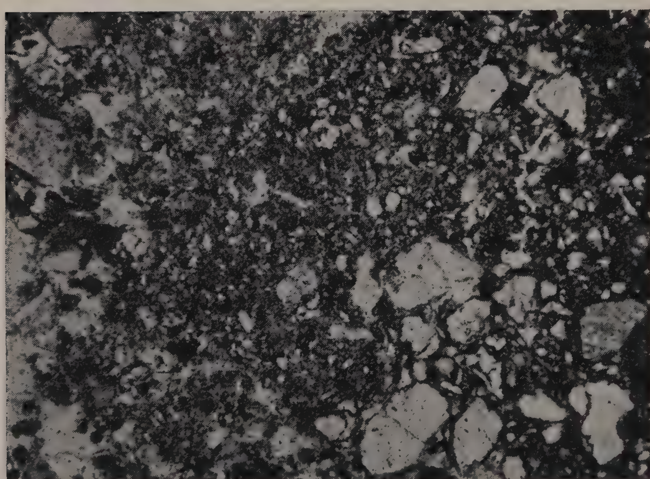




1, 2. Redbridge, Old Bone Mill. The large body (X) is a flint, of which only about half comes into the field. There are no colloids and practically nothing but quartz, in the way of minerals, save a tiny flake of muscovite (Y), seen edge-on.

PLATE VI





1, 2. Luzborough brickearth. A group of coarse quartzes in a thin colloid matrix. There is a large flint in the opposite corner (X). (Y) shows a well-rounded, brown, weathered glauconite, between the two large quartzes. The definition is locally spoiled by halation from these.

Palaeoliths of special interest

by A. D. LACAILLE

I

For more than a century research in Lower Palaeolithic typology has been actively pursued. Owing to the great progress made, we might think that the standard forms of tools wrought in stone would by now be known, especially as collections from all the continents of the Old World have been so attentively scrutinized, and their constituents separated, classified, described, discussed and reviewed. Indeed, even eighty-seven years ago it seemed that the archaeologists Gabriel and Adrien de Mortillet had reached finality when their plentifully and masterly illustrated catalogue of large format appeared. Nevertheless, a little more than twenty years later the second-named was able in a volume of handier size to give elaborated lists of representative implements of every stage of man's prehistoric industrial development. Today it would be difficult to say how many works published since have brought to notice stone tools of shapes and even kinds unsuspected formerly. Advance in this knowledge, particularly of the Old Stone Age output, certainly results from improved methods of inquiry by excavation or otherwise. By wiser and more comprehensive collecting, too, it has been demonstrated that many forms produced by ancient man could be added to the lists, proving that technical practices were more diversified than one had imagined.

Other considerations apart, from the innumerable specimens yielded by Pleistocene deposits in Europe, Asia and Africa we know that the Acheulian was the longest-lasting of our early forerunners' so-called cultures. Since their chronological range extended from the Second or Great Interglacial (Mindel-Riss) in Europe until the fourth (Würm) Glaciation and the equivalents of these periods outside our continent, it stands out that they spanned an infinitely longer spell than the remainder of prehistoric and historic time together. Evolved from the elementary process of detaching a few chips from cobbles, and so converting these into rudimentary tools, the Acheulian industries eventually turned out a great variety of implements. It is clear that in the manufacture of these objects over the ages the artisans had discovered and applied certain principles. In time many of the tool-forms that were based on these came to be made in metal and now persist in daily domestic and trade articles.

Among the divers tools that exemplify the following of well-tried rules are hand-axes, ovates, cleavers and most scrapers. The generally trihedral picks, sometimes encountered in Lower Palaeolithic assemblages and manifestly intended for simple use otherwise than by the employment of a short or long edge disposed horizontally, belong to a different order. In contradistinction to the ovates and especially the cleavers of the first category, the pick-like tools seem to have been produced more widely in the valleys of the rivers flowing northerly into the depression that is now the Channel than in the Thames drainage.

Having considered the artifact and literary evidence, and observing that so many legacies of the Acheulian workers in flint and other rocks are to be found in later prehistoric and modern tools, I have on occasion drawn notice to a number of implements attributable to those Lower Palaeolithic people but out of the ordinary run of their equipment. To Professor François Bordes, however, prehistorians owe a debt of gratitude for collating the records of normal and exceptional palaeoliths from Abbevillian to Mousterian and placing them in categories designated on morphological criteria. Not surprisingly, the most diversified of the tools made in nodules are those executed by bifacial flaking or more freely according to the surfaces presented by the raw material. Whether or not M. Bordes has separated the implements in his repertory into an excessive number of divisions is less important than his demonstrating by scores of drawings that the Acheulian output includes so many well-defined main types. Looking over the figures in his book one sees that in the majority of core- and flake-tools the effective working-edge lies in the horizontal plane. This is also abundantly obvious from illustrations in all works concerned with Lower Palaeolithic artifacts. A type of Acheulian core-tool with its true working-edge at right angles to the horizontal, and distinct from a pick, seems to have eluded Professor Bordes and other authors, save one, so far as I know. In all my experience I had encountered but a single specimen of the kind until quite recently when a second example appositely came my way. This, I think, now justifies my recording the two as representative of yet another sort of Palaeolithic implement, the cutting-edge of which diverges from normality.

The first, No. 1, I noticed many years ago in the Wellcome Prehistoric Collection (acc. no. 80,350). It bears an original label stating that one S. Aldridge picked up the palaeolith in 1883 on the site of 14 Uverdale Road, on the Ashburnham Estate, Chelsea. Improvised as a tool by the bilateral steep flaking of the beak-like extension of a greenish-grey flint cobble, it measures 11.5 cm. in length, 8.2 cm. in width and 5 cm. in thickness. The treatment of the projection has produced a short lower cutting-edge and an incomplete upper one near the body of the nodule. Hence, while at first sight the implement might be taken for a pick (and indeed could have so served), it is when held in the hand that the true purpose of the artifact as a knife for heavy duty becomes manifest. For the gibbous corticated butt, fitting with more than ordinary ease within the all-

adaptable hand, makes plain that the only comfortable way of holding the stone at once indicates its use.

Interest other than typological, technological and functional attaches to the palaeolith from Chelsea, for something can be deduced from its condition. The edges of the tool retain their pristine sharpness and the scars are only slightly lustrous. This state of preservation suggests, not that the tool was derived from a much higher level and eventually incorporated in the flood-plain gravel or alluvium upon the fringes of which Uverdale Road stands, after the vicissitudes attendant on glaciations and carriage by swollen waters with other stones, but rather that the implement was an ingredient of a load of fluviatile gravel extracted from the burden of the 33 m. (100-ft.) terrace of the Thames and brought by contractors to the place. Now occupied by pre-fabricated dwellings, this has been determined to stand no more than 3 m. (9.75 ft.) above mean water-level in the nearby Chelsea Creek.

In condition quite unlike that of the very rare and invariably abraded and pebbled, derived palaeoliths recovered from low-lying beds in the Thames valley, the specimen discussed above is of course referable to well-developed Acheulian workmanship of the Great Interglacial Period, called the Penultimate Interglacial by Zeuner. This is commonly correlated with the Mindel-Riss of Penck's and Brückner's Alpine sequence and more recently with the genial spell recognized in East Anglia and named by a modern school after Hoxne, where it is so well recorded in lacustrine sediments. Moreover, the tool compares in treatment with that expressed in the Acheulian (Breuil's III–IV) yield of the Middle Gravel at Swanscombe, Kent, and its equivalents upstream, say at Lent Rise, Burnham, Bucks, and Furze Platt, Maidenhead, Berks.

Appropriately enough, it is from Swanscombe that I am able to illustrate the second specimen. As famous for the human skull fragment taken from the Middle Gravel as for the extraordinarily comprehensive yield of Lower Palaeolithic forms contemporary with the containing deposit, this place provides the Middle Acheulian standards for southern Britain and comparisons abroad. Despite this, none of those who, since the early years of this century, have studied the locality and written, or contributed monographs on its geological, archaeological and allied aspects, appears to have noticed any Lower Palaeolithic artifact from Swanscombe that strictly matches the implement from Uverdale Road. However, a somewhat similar but more finely worked tool from Swanscombe has been figured in a British Museum handbook on stone age techniques. Herein, though admittedly described as a knife or scraper, it is considered to be in fact only a hand-axe with one edge left blunt. This seems to do less than justice to a definite type that embodies the essential principle of a working-edge set in a particular manner departing from common usage.

Quite fresh-looking and not even lustrous, No. 2 is an excellent piece that illustrates these characteristics. As an item of the Marston Collection, now in

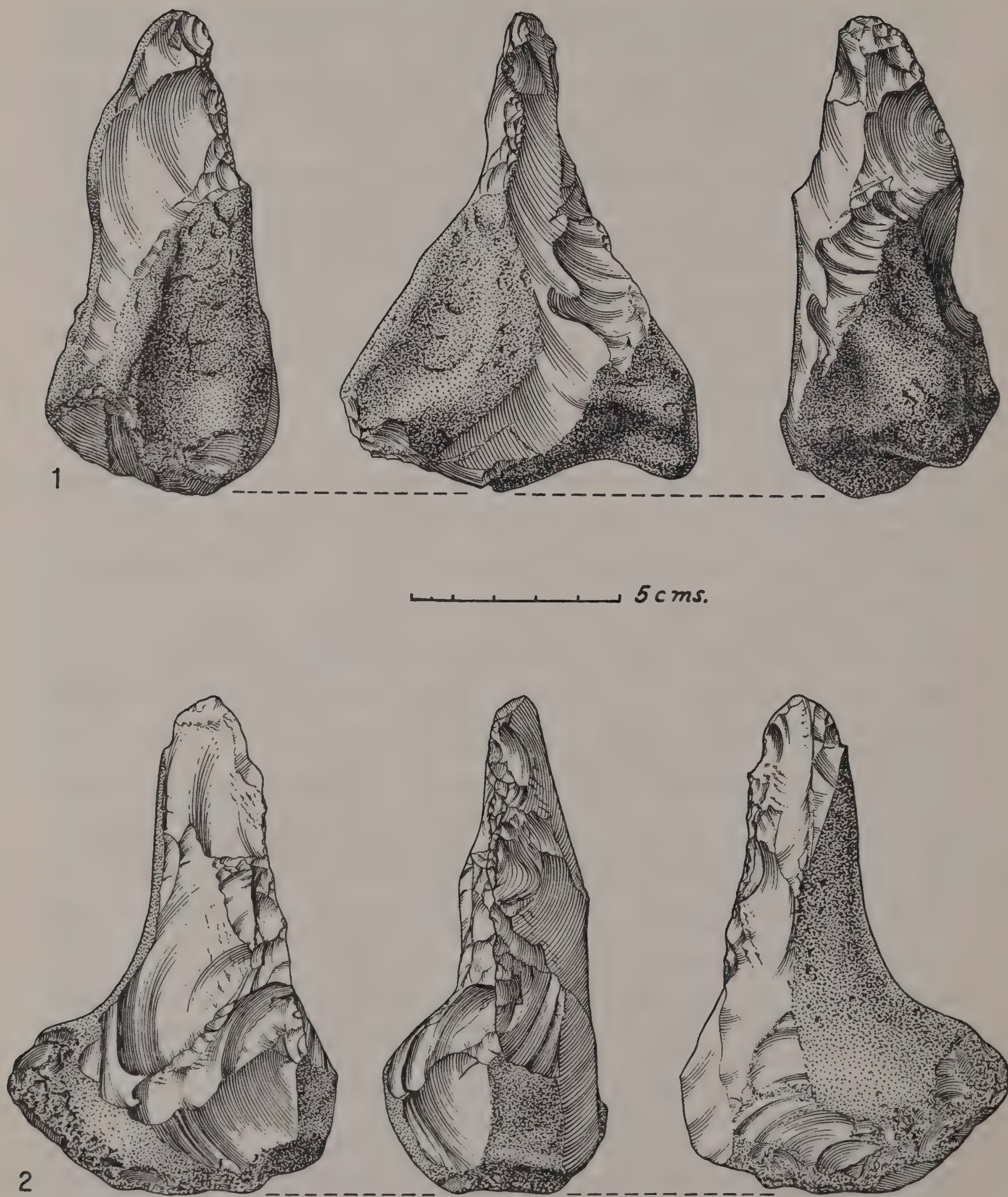


Fig. 1 1 Lower Palaeolithic (Acheulian) tools with single cutting-edge
1 Uverdale Road, Chelsea
2 Swanscombe, Kent (with acknowledgments to the British Museum)

the British Museum (Bloomsbury) and bearing the indication of having been found in the Middle Gravel at Swanscombe, it is exceptionally delicately flaked bilaterally along the narrow elongated end of a cobble of grey-green flint. Some dulled, shallow, ochreous-stained, naturally produced scars occur on the globular butt. In dimensions, 11.9 cm. long, 7.8 cm. at its widest and 5.1 cm. at its thickest, this artifact closely resembles the companion example from Chelsea. Not only so, but the measurements of the two, like those of the other single-edged core-tool from Swanscombe, conform to the average of Thames valley Acheulian implements. The principal are of course these palaeoliths with unworked rounded butts heavily coated with the natural crust of the selected conveniently sized nodule. Together, these features surely indicate that such tools did not need a holder but were intended to be used unhafted.

II

Until not so long ago prehistorians here regarded as axiomatic that man's Middle Palaeolithic stone equipment consisted virtually only of weapons and domestic implements based on flakes. In this it differed from that of Acheulian predecessors made up of core-tools and implements mainly improvised on waste flakes. Now, of course, we know that bifaces were far more commonly made in Middle Palaeolithic industries than was formerly suspected outside the Mousterian range in cave-bearing country, owing to an increasing awareness of the Levalloisian output in open regions and river valleys. Even more firmly has the student been grounded in the idea that the Upper Palaeolithic people were devoted almost entirely to the use of fine blades, as distinct from flakes, for their ordinary domestic and hunting-gear. Yet, if we turn to a number of reports on the excavations of cave- and even open-air sites in France alone we shall find the mention of tools bifacially fashioned in pebbles and cobbles much resembling remote Lower Palaeolithic forerunners. Such objects have at least a two-fold interest, technological and utilitarian. For they not only testify to the survival of extremely ancient tradition in form and craftsmanship, but provide evidence of the continuance or return and prevalence of certain requirements that, as in earlier times and dictated by environment, called for appropriate forms of tools.

For support of the last statement we need only look at some clutches of artifacts, particularly in France with its classic regions and sites that furnish most late Old Stone Age standards. While very many examples could be adduced from there, I have chosen two for illustration. These suffice to shew that to the figures in text-books, that are so prone to stress only the finest forms as typifying each culture, may be added the representations of heavier tools that were just as much part of Upper Palaeolithic man's kit.

At some of the cave-stations in the borderlands of the Allier and Saône-et-Loire departments a facies of the industries passes from what may be described as Abri-Audi late Middle Palaeolithic into Châtelperronian early Upper

Palaeolithic, even more decisively, I think, than at sites I studied long ago in Périgord. Of such places in both districts, where the sequence from Middle to Upper Palaeolithic has been found stratified, there occur bifacial implements mingled with flake- and blade-tools of the evidently later culture. Instances of such mixtures were mentioned quite early this century from a cave at Germolles (Saône-et-Loire). Not far from this, too, with slightly more advanced knives or points marking the name-site of early Upper Palaeolithic stone-riving, La Grotte des Fées at Châtelperron (Allier), there comes at least one small ovate. This differs in execution from even the most evolved local Acheulian implements.

Again I can point to a cordiform ovate that I got with many admirable blade-tools by excavations at an open-air site in the forest on Le Redan, Beauregard, above the Loing river near Nemours (Seine-et-Marne). Since this specimen was discovered in 1931 I have no reason to alter my opinion that it was of well-developed Aurignacian make. To the same idiom and its equivalents of the Upper Palaeolithic complex are of course ascribable bifaces occasionally found associated with typical products of blade-industries in rock-shelters and cave-mouths.

True bifaces, large and small, in Upper Palaeolithic contexts in the valley of the Vézère have certainly prompted some discerning finders to draw notice on them. Cruder and heavy forms such as choppers and heavy scrapers, nevertheless, seem to have been regarded as less worthy of comment as constituents of Upper Palaeolithic series. That this is by no means so has appeared to me from examples of considerable typological and technological merit housed in museums, confessedly more frequently among workshop scraps than in study series. Within a circle of moderate radius having Les Eyzies as its centre, at some sites the spoil heaps from archaeological diggings have rewarded me with several specimens of kinds that the excavators ought to have preserved with indications of the containing deposits and associations. Fortunately, I am able to illustrate two such implements. These were given to me by Abbé H. Breuil and are now in the Wellcome Prehistoric Collection (acc. nos. 255,561–2), positively from a Gravettian layer with characteristic delicate, narrow knives and points in the Labatut rock-shelter, one of a group of habitats at Les Roches, Sergeac (Dordogne). Believing that these specimens belong to an Upper Palaeolithic order as yet unfamiliar to students here, I feel that they deserve comment. No. 3, 10.5 cm. long, 6.6 cm. wide and 6 cm. thick, though not entirely flaked over, in workmanship resembles many Lower Palaeolithic forerunners. The method of scarring, however, is peculiar, shewing that in its fashioning the intended implement was primarily treated by the parallel detaching of narrow blades from the parent cobble. The resulting rough-hewn piece was next subjected to short bold retouch applied inward from the edge. The reverse was more simply dealt with by flaking. One blow involved the upper curvilinear end, leaving a scar like that on a *tranchet* or cleaver. Evidence of

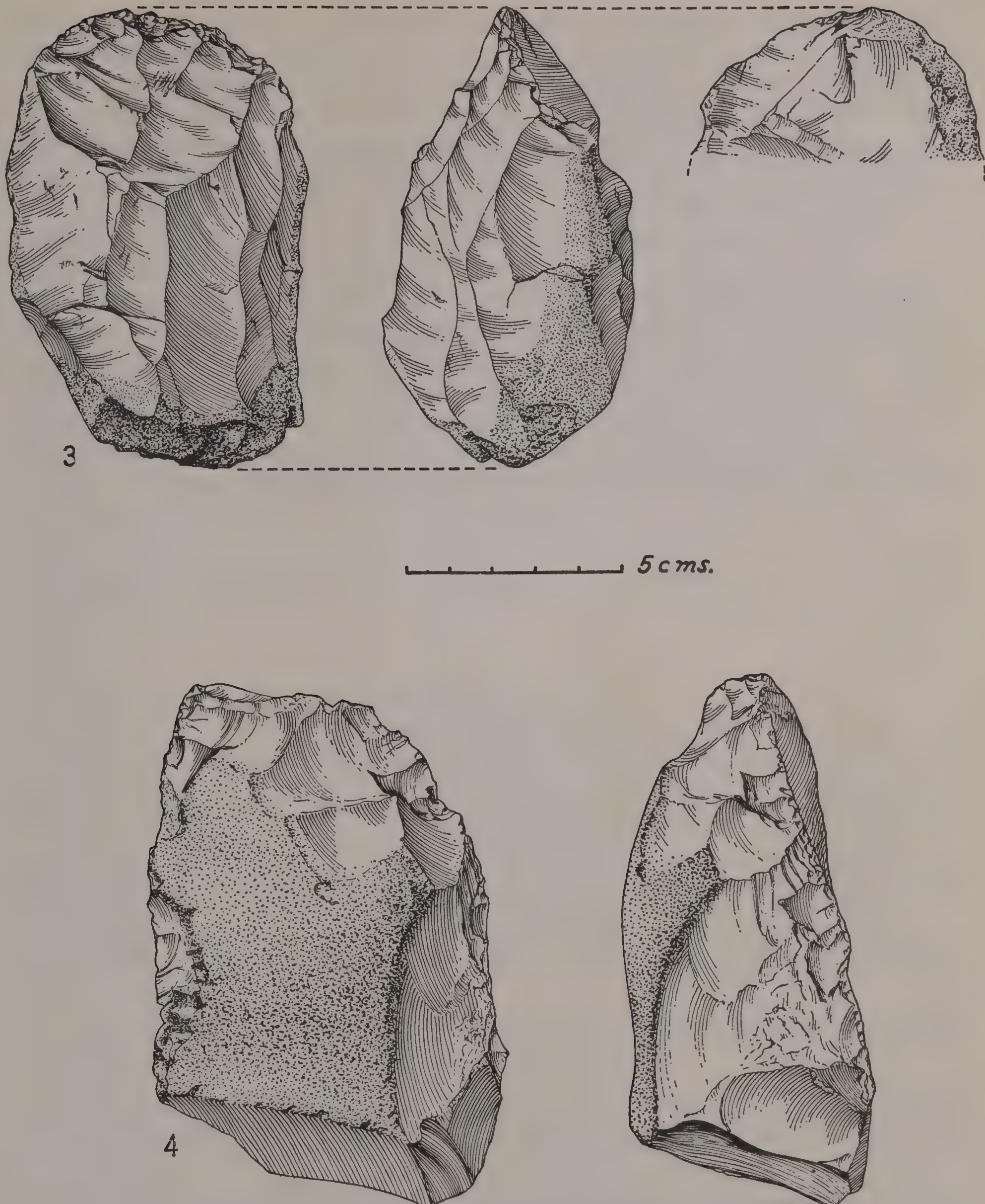


Fig. 2 Upper Palaeolithic (Gravettian) bifaces
3 and 4 Les Roches, Sergeac (Dordogne)

similar manufacture appears in the massive tool No. 4. To two main uses this implement could have been put, as a side-scraper for exceptionally heavy duty and (which seems more likely) as a chopper. Wrought by short flaking on the corticated surface, bifacially at the top and simply for the whole of the convex long side, it is 13 cm. long, 8.5 cm. wide and averages 4 cm. in thickness. On the nether surface a long and wide, intentionally produced scar intersects with the faceting of the obverse. This has resulted in an efficient cutting-edge.

The foregoing discussion of the scarring on the surfaces of the two Upper Palaeolithic objects (Nos. 3 and 4) is a justifiable accompaniment of the illustrations. For it is thought that while these tools carry down Lower and Middle Palaeolithic traditions in their shapes and probable purposes, the differences in actual execution deserve notice. Studies of comparable Upper Palaeolithic products confirm this. They shew, moreover, that what at first sight may seem to be waste in factory spoil, on examination proves to be intentional making and not simply improvisation. Such artifacts exemplify a class of Upper Palaeolithic implements that has a definite place and merits attention.

SHORT BIBLIOGRAPHY

Gabriel et Adrien de Mortillet, *Musée Préhistorique*, Paris, 1881; 1903.

François Bordes, *Typologie du Paléolithique Ancien et Moyen*. Publications de l'Institut de Préhistoire de l'Université de Bordeaux. Mémoire No. 1. 1961.

The Swanscombe Committee of the Royal Anthropological Institute: 'Report on the Swanscombe Skull', *Journ. Roy. Anthrop. Inst.*, lxviii, 1938, 30–54.

Flint Implements, British Museum, third edition, 1968.

A. D. Lacaille, 'Châtelperron: a New Survey of its Palaeolithic Industry', *Archaeologia*, xcii, 1947, 109–10; 'Contribution à l'Etude du Paléolithique Supérieur du Gâtinais', *Bulletin de la Société Préhistorique Française*, xxix (1932), 272–3.

L. Capitan et D. Peyrony, 'La Madeleine . . .', *Publications de l'Institut International d'Anthropologie*, No. 2 (Paris, 1928), 27–9.

Interpretation of Land Snail Faunas

by J. G. Evans*

It was recognised towards the end of the last century that assemblages of sub-fossil land and freshwater Mollusca from Pleistocene and Holocene deposits could be used to interpret the status of ancient environments.[1] The main protagonist of this subject in Britain was A. S. Kennard who, working over a period of some fifty years, made a number of regional studies[2] and also took a particular interest in the Mollusca from archaeological sites, mainly in the Chalk downland areas of the south and east of England. One of the first major studies of this kind was on the Neolithic flint mines, Grime's Graves in Norfolk[3] in which Mollusca were used not only as indicators of local environmental conditions, but as evidence for a Holocene age for the mines in relation to the controversy which was then current on this topic.[4] In Wiltshire, Kennard is

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*In this article the following are the abreviations used:

P.P.S.:	*Proceedings of the Prehistoric Society.*
P.P.S.E.A.:	*Proceedings of the Prehistoric Society of East Anglia.*
Phil. Trans. Roy. Soc.:	*Philosophical Transactions of the Royal Society of London.*
W.A.M.:	*The Wiltshire Archaeological and Natural History Magazine.*
Proc. Geol. Ass. Lond.	*Proceedings of the Geologists' Association of London.*
Proc. Malac. Soc. Lond.:	*Proceedings of the Malacological Society of London.*
Trans. Herts. Nat. Hist. Soc.:	*Transactions of the Hertfordshire Natural History Society.*
J. Conchol.:	*The Journal of Conchology.*
Proc. Linn. Soc. Lond.:	*Proceedings of the Linnean Society of London.*

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[1] Lane-Fox, A. H., 'Further remarks on the hillforts of Sussex: being an account of excavations in the forts of Cissbury and Highdown', *Archaeologia* 42 (1869), 53–76. Willett, E. H., 'On flint workings at Cissbury, Sussex', *Archaeologia* 45 (1872), 337–348.

[2] Kennard, A. S., 'The Post-Pliocene non-marine Mollusca of Essex', *Essex Naturalist* 10 (1897), 87–109; 'The Holocene non-marine Mollusca of England', *Proc. Malac. Soc. Lond.* 15 (1923), 241–259; 'The Post-Pliocene non-marine Mollusca of Hertfordshire', *Trans. Herts. Nat. Hist. Soc.* 22 (1943), 1–18.

[3] Kennard, A. S., and Woodward, B. B., in Clarke, W. G., *Report on the excavation of Grime's Graves, Weeting, Norfolk: 1914* (London, 1915), 220–231; in Peake, A. E.,' Excavations at Grime's Graves during 1917', *P.P.S.E.A.* 3 (1919), 73–93; and Kennard, A. S., in Armstrong, L. A., 'Grime's Graves, Norfolk: Report on the excavation of pit 12', *P.P.S.E.A.* 7 (1934), 382–394.

[4] Clark, J. G. D. and Piggott, S., 'The Age of the British Flint Mines', *Antiquity* 7 (1933), 166–183.

best known for his work with Mrs. M. E. Cunnington[5] who was so taken with the potentialities of land snails as to write a paper on the subject entitled: 'Evidence of climate derived from snail shells and its bearing on the date of Stone Henge'[6]; and also with J. F. S. Stone[7] especially on the series of excavations at Easton Down.

Kennard died in 1948 and since then the investigation of land snails from archaeological sites has assumed a minor role. Major J. P. T. Burchell[8] attempted a synthesis of the Holocene land Mollusca in south-east England and suggested the characterisation of the successive stages of this period through the composition of land mollusc assemblages. Other work in the archaeological field has generally been limited to short notes appended to excavation reports[9] and with the exception of one or two papers[10] no attempt has been made to relate the study of land Mollusca specifically to archaeological investigations. Most workers have preferred a more geological approach.

It is apparent that the potential of the application of molluscan analysis to archaeological sites has not been fully realised, and this for a number of reasons. First, the collection and extraction of material from soils and sediments has often been on a partial basis resulting in an over-representation of the larger species[11] and leading to faulty interpretation of the assemblages.[12] Second, insufficient attention has been paid to the stratigraphy of the deposits from which shell collections were made, and too much dependence put on the results of molluscan analysis alone.

[5] Kennard, A. S., in Cunnington, M. E., 'The Sanctuary on Overton Hill, near Avebury', *W.A.M.* 45 (1931), 300–335; 'Excavations in Yarnbury Castle Camp, 1932', *W.A.M.* 46 (1933), 198–213.

[6] *W.A.M.* 46 (1933), 350–355.

[7] Kennard, A. S., in Stone, J. F. S., 'Excavations at Easton Down, Winterslow, 1931–1932', *W.A.M.* 46 (1933), 225–242; and in Stone, J. F. S., and Hill, N. G., 'A round barrow on Stockbridge Down, Hampshire', *Antiquaries Journal* 20 (1940), 39–51.

[8] Burchell, J. P. T., 'Land-shells as a critical factor in the dating of post-Pleistocene deposits', *P.P.S.* 23 (1957), 236–239; 'Land shells and their role in dating deposits of Post-glacial times in South-east England', *Archaeological News Letter* 7 (1961), 34–38; and with Piggott, S., 'Decorated prehistoric pottery from the bed of the Ebbsfleet, Northfleet, Kent', *Antiquaries Journal* 19 (1939), 405–420.

[9] Sparks, B. W., in Alexander, J., *et al* 'Report on the investigation of a round barrow on Arreton Down, Isle of Wight', *P.P.S.* 26 (1960), 263–302; Kerney, M. P., in Christie, P. M., 'A barrow cemetery of the second millenn um B.C. in Wiltshire . . .' *P.P.S.* 33 (1967), 336–366; Evans, J. G., 'Land Mollusca from the Neolithic enclosure on Windmill Hill', *W.A.M.* 61 (1966), 91–92.

[10] Sparks, B. W., 'Non-marin mollusca in archaeology', *Science in Archaeology* (*ed.* Brothwell, D., and Higgs, E.) (London, 1963), 313–324; Connah, G., and McMillan, N. F., 'Snails and Archaeology', *Antiquity* 38 (1964), 62–64.

[11] Castell, C. P., in Manby, T. G., 'The excavation of the Willerby Wold Long Barrow, East Riding of Yorkshire', *P.P.S.* 29 (1963), 173–205; Cain, A. J., in King, D. G., 'The Lanhill Long Barrow, Wiltshire, England: an essay in reconstruction', *P.P.S.* 32 (1966), 73–85.

[12] Sparks, B. W., 'The ecological interpretation of Quarternary non-marine Mollusca', *Proc. Linn. Soc. Lond.* 172 (1961), 71–80.
Collection of large shells is to be recommended as this provides a good series of adult examples, generally few in soil samples. Large samples of the polymorphic snails, *Helix* (*Cepaea*) *nemoralis* Linné and *H. hortensis* Müller, are needed for work which is being done on the genetics of these species (Cain, A. J., and Currey, J. D., 'Area effects in *Cepaea*', *Phil. Trans. Roy. Soc.* B, 246 (1963), 1–81; Cain, A. J., *et al*, 'Studies on *Cepaea*', *Phil. Trans. Roy. Soc.* B, 253 (1968), 383–595). Also, it may in the future be possible to use shell material for radio-carbon dating.

Sparks was the first in Britain to apply serial sampling techniques to mollusc-bearing deposits. Groups of ecologically related species were plotted as percentage frequency histograms and vertical changes in these interpreted in terms of changing local environmental conditions.[13] In a review article[14] methods of sampling and extraction are discussed and some of the problems involved in the graphical presentation of the results and the difficulties of interpretation considered. More recently, these methods have been applied to the Late Weichselian and Post-glacial history of the Chalk lands of south-east England[15] in studies which though partly geological have demonstrated the effects of man in altering the landscape during the later part of the Post-glacial. Of more specific interest to the archaeologist is the writer's thesis[16] and a recent paper[17] in which land snails are used to demonstrate some of the environmental changes associated with the formation of Iron Age lynchets.

But perhaps the fundamental reason behind the unpopularity of molluscan analysis with archaeologists is bound up with the interpretation; too often this has been of an uncritical nature, biased by attempts both to date deposits and to make deductions about past climatic conditions. The basis of many of Kennard's interpretations is climatic, and generally in terms of the prevailing humidity as controlled by rainfall. It is, however, notoriously difficult to make inferences about climatic data from palaeobiological material as the effects of local environmental conditions are difficult to discount; and this applies to land snails even more than to pollen. Similarly, the dating of Holocene deposits by means of Mollusca as advocated by Burchell is to be regarded with circumspection until more critical data are available; even then it is debatable whether it will be possible to develop a scheme as critical as that of the pollen zones of north-west Europe owing to the extreme reaction of Mollusca to local ecological conditions. At present it can be shown that in the Late-glacial period (pollen zones I to III) there is a restricted and characteristic fauna; that in the early Post-glacial certain of the more tolerant thermophile elements of the fauna become present, and that the period is characterised by a number of Boreal-Alpine species (zones IV to VI); and that in the Atlantic period (zone VIIa) these latter fall off in abundance while other, less tolerant thermophiles come

[13] Sparks, B. W., 'The non-marine Mollusca of the interglacial deposits at Bobbitshole, Ipswich', *Phil. Trans. Roy. Soc.* B, 241 (1957), 1–44.

[14] Sparks, B. W., *op. cit.* fn. 12.

[15] Kerney, M. P., 'Late-glacial deposits on the Chalk of South-east England', *Phil. Trans. Roy. Soc.* B, 246 (1963), 203–254; Kerney, M. P., Brown, E. H., and Chandler, T. J., 'The Late-glacial and Post-glacial history of the Chalk escarpment near Brook, Kent'. *Phil. Trans. Roy. Soc.* B, 248 (1964), 135–204; Evans, J. G., 'Late-glacial and Post-glacial subaerial deposits at Pitstone, Buckinghamshire', *Proc. Geol. Ass.* Lond. 77 (1966), 347–364.

[16] Evans, J. G., *The stratification of Mollusca in Chalk soils and their relevance to archaeology* (1967), Ph.D. thesis, University of London.

[17] Fowler, P. J., and Evans, J. G., 'Plough-marks, lynchets and early fields', *Antiquity* 41 (1967), 289–301.

in. Such changes can be largely related to an increase in temperature. With the onset of the period of Neolithic colonisation (zone VIIb), the land snail fauna becomes characterised by a high proportion of xerophile and heliophile species, generally absent from zone VIIa. This is associated with the influence of Neolithic man in clearing areas of woodland for agricultural use and is not necessarily a reflection of climatic change alone.

The introduction by man of new species, either accidentally or deliberately for food into Britain at certain periods may be used as a criterion for dating. At the moment insufficient evidence is available for this concept to be of any particular value though it does seem that at least one species, *Helix aspersa* Müller, was not introduced until the beginning of the Roman period at any rate in southern England.

Land Mollusca are thus most useful as indicators of local environmental conditions, e.g. type of vegetation cover, degree of disturbance by man, etc. Only to a limited extent can they be used as a criterion of the age of a deposit or of the exact climatic conditions (temperature and rainfall) at the time the deposit was formed.

It may now be useful to discuss some of the molluscan evidence relating to a particular environmental problem, even if it is only to demonstrate some of the complexities involved.

The environmental changes which took place in Britain and north-west Europe round about 3000 B.C., the so-called Atlantic/Sub-boreal (zone VIIa/VIIb) transition reflected in the pollen record by a marked drop in the value for elm, have claimed particular attention from archaeologists. In Britain this coincides with the arrival of Neolithic man and the controversial question of whether the elm decline was caused by biotic or climatic factors has not been settled. The molluscan evidence is likewise ambiguous. Thus it has frequently been claimed that the presence of certain species of land snail in deposits of Neolithic origin from downland areas in the south and east of England is evidence of conditions climatically wetter then than at the present day.[18] Of these, the most notable are *Pomatias elegans* Müller, *Acicula fusca* Montagu, *Vertigo pusilla* Müller, *Lauria cylindracea* da Costa, *Ena Montana* Draparnaud, *Clausilia rolphi* Turton, *Helicodonta obvoluta* Müller, *Arianta arbustorum* Linné and *Helix hortensis*, all species which are now locally extinct or greatly reduced in numbers in areas where they once thrived, and all of which find their best conditions for life in rather damp, shaded places such as among leaf-litter, beneath logs or in wall crevices.

The evidence of a change in the distribution pattern of these species is clear enough and not disputed; it is the interpretation that is questioned. First,

[18] Kennard, A. S., *op. cit.* fn. 2 (1923); Piggott, S., *The Neolithic Cultures of the British Isles* (Cambridge, 1954).

if we are dealing with an environment which is becoming progressively drier, and this seems likely, is this a function of climatic change, or are other factors responsible? Second, are factors other than a drying out of the environment involved?

To answer the first of these points, we need look no further than the activities of man. Woodland clearance was initiated on the Chalk lands of the south and east well before 3000 B.C. and must have resulted in a lowering of the water-table and a drying out of the soil. It has been shown too[19] that prior to the beginnings of cultivation, the Chalk was mantled with a cover of drift, mainly of periglacial origin, which would have made for generally richer and more moisture retentitive soils than the rendsinas so characteristic of the downland today. Cultivation on the Downs has led to the erosion of large tracts of these deposits. An additional effect of the long period of virtually continuous land use is that very few, if any, of the woodland areas on the Chalk today are of primeval origin and the land on which they stand has almost certainly been cultivated at one time or another. Only the 'hangings' on the steepest slopes may have been left untouched. Re-afforestation of once cultivated areas may restore the environment to its original state but will not counteract the effect of disturbance on the molluscan fauna. Each species needs a certain minimum area of optimum habitat if it is to survive and with the increase in man's activities through the Neolithic and Bronze Age periods such areas became increasingly less available until it seems, that on high downland at any rate, clearance proceeded to such an extent as to preclude completely some of the more conservative members of the molluscan fauna. Thus to compare the fauna from woodland areas of the Downs today with that during the Neolithic period, without taking into account differences in soil moisture content and the long history of land use such areas have suffered is totally invalid.

Before going on to the question of whether factors other than the moisture regime are responsible for causing changes in the molluscan fauna let us consider further evidence which might be interpreted as reflecting a climatic change from wet to dry. There is a group of about four species, likewise frequent in the south and east during zone VIIa but unlike the above group, not known from Neolithic or Bronze Age deposits and at the present day virtually restricted to the north and west of Britain. These are *Vertigo alpestris* Alder, *Vertigo substriata* Jeffreys, *Lauria anglica* Wood and *Acanthinula lamellata* Jeffreys. Their behaviour would seem clearly to reflect a climatic change to drier conditions and their restriction to the north and west to be correlated with the damper climate in that area as compared with the south and east. But at this stage it is necessary to introduce a concept which is of some importance in understanding the distribution of snail populations. If a change takes place in

[19] Evans, J. G., 'Periglacial deposits on the Chalk of Wiltshire', *W.A.M.* 63 (1968), 12–26.

an environmental factor to the detriment of a snail species, though this change be uniform over a wide area that species may react by becoming restricted to areas which are optimum in other environmental factors, with the result that it will appear that the species is reacting to a change in those factors which are now controlling its distribution and not to that factor whose value has changed. Thus, to take the case at hand, it appears that rainfall is the controlling factor but it is not necessarily a change in this which was responsible for the change in the pattern of faunal distribution. If this were the case it is difficult to explain the persistence of at least two of the group, namely *Vertigo substriata* and *Acanthinula lamellata*, in areas of ancient woodland in the south to the present day. More likely, we are again dealing with the effects of human interference with the landscape, and although this may be acting uniformly over the British Isles, variability of other environmental factors—in this case rainfall—results in an alteration of the distribution pattern.

We have so far tried to demonstrate that the changing pattern of distribution of certain snail species in Britain since the Neolithic period has been effected by human interference, causing a drying out of the soil and continuous disturbance of the habitat. This has resulted in one group of species becoming locally restricted to low-lying, more sheltered and moist habitats and another becoming more generally restricted to areas of high rainfall in the north and west. It has recently been shown through a detailed comparison of present-day and Post-glacial distributions of certain members of the former group—notably *Pomatias elegans* and *Lauria cylindracea*—that a considerable area in the east of England was once colonised by these species in which they are now rare or entirely absent. It is known that these species are controlled to some extent by winter frosts and their restriction towards the west in the Post-glacial would seem to indicate a fall in winter temperatures during that time. Similarly, others of the group—notably *Ena montana*—whose range is restricted by summer temperatures show a southerly shift in their distribution during the Post-glacial,[20] thus indicating a fall in summer temperatures since the Neolithic period; the same may also apply to *Acicula fusca*, *Clausilia rolphi* and *Helicodonta obvoluta*. It seems clear then that a fall in mean annual temperature since the Neolithic period has taken place and that this has had a contributory effect together with human interference in altering and generally restricting the distribution pattern of certain land snail species since that time.

Figure 1 shows the changing pattern of distribution of the land snail species *Helicodonta obvoluta* during the last two interglacials (Ipswichian and Hoxnian) and during the Post-glacial in southern England.[21] Taking the records as a

[20] Kerney, M. P., 'Britain's fauna of land Mollusca and its relation to the Post-glacial thermal optimum', *Symposia of the Zoological Society of London*, no. 22 (1968), 273–291.

[21] The records have been plotted on a 10 km. square basis as advocated by the Conchological Society's mapping Scheme (Kerney, M.P., 'The distribution of *Abida secale* (Draparnaud) in Britain', *J. Conchol.* 25 (1962), 123–126). This means that not every record is necessarily plotted as a separate entity; if two or more records fall within a single 10 km. square only one plot is made, perhaps giving a fairer picture of the distribution.

whole, a marked southerly shift since the interglacial periods is apparent perhaps indicating lower summer temperatures during the Post-glacial than during the interglacials. The Post-glacial records show a severe restriction in the area of distribution but here, the pattern of change would perhaps reflect as much the influence of human interference as of a fall in summer temperature. *Helicodonta obvoluta* has always attracted much attention from archaeologists and conchologists alike, partly due to its curious, flattened form (its common name is the cheese snail) and partly due to its rarity. It was among the earliest species of snail to be recorded from an archaeological site[22] and its occurrence

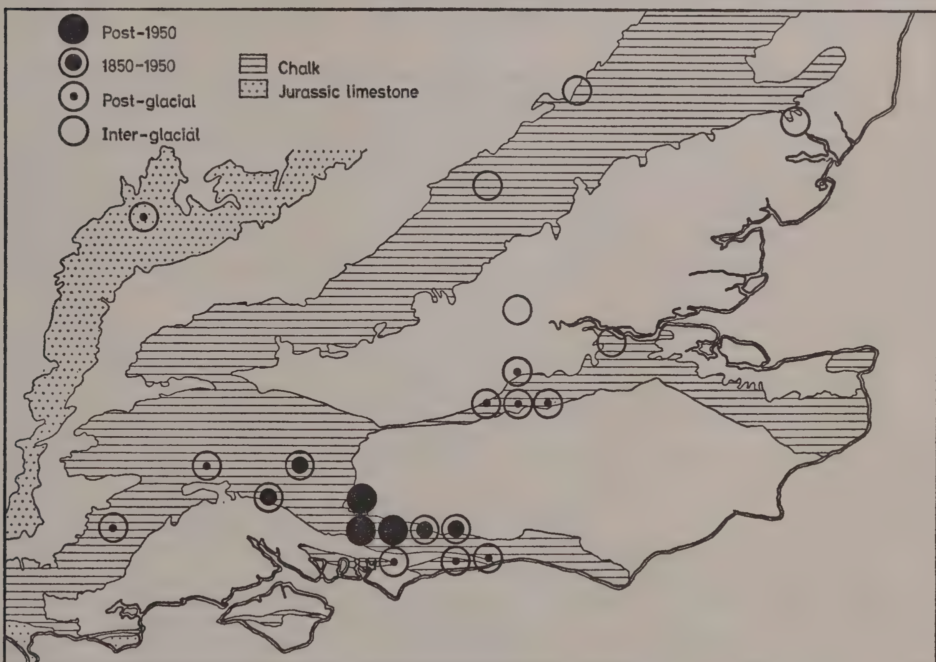

Fig. 1 The distribution of *Helicodonta obvoluta* in England during the Hoxnian and Ipswichian Interglacials and the Post-glacial.

in the flint mines at Easton Down in Wiltshire and near Findon in Sussex was used as evidence of a damper climate during the Neolithic period. I hope that this note has demonstrated that such a view can no longer be maintained.

The environmental factors controlling the distribution of land snail populations are numerous and of complex interaction; and they are not readily separable especially when anthropogenic influences are involved. Other factors

[22] Willett, E. H., *op. cit.* fn. 1.

which we have not considered but which may well be of some importance are the interaction of one species on another (competition), freak local condition such as the 'frost hollows' of Chalk dry valleys,[23] molluscan parasites and predators and changes in the ecological requirements (biotype) of the snail species themselves. To my mind the investigation of sub-fossil land Mollusca can only be made with the full co-operation of other disciplines—soil science, archaeology and botany—in detailed analyses of ancient environments. Only then will it be possible to separate adequately the various habitat factors, controlling the composition of molluscan populations at any one time and place, and to be certain of the relative importance of climatic, anthropogenic and local environmental elements.

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[23] Cain, A. J., and Currey, J. D., *op. cit.* fn. 12.

Late Bronze Age and Earliest Iron Age in U.S.S.R.

(A Guide to the Recent Literature on the Subject)*

by T. Sulimirski

In my third report on the archaeological literature in the U.S.S.R.[1] that appeared approximately between 1958 and 1968, I propose to concentrate mainly on books, pamphlets and articles dealing with the first half of the first millennium B.C. A review of the literature relating to the second part of the millennium, concerned with topics connected with the Scythians, Sarmatians and Greek colonisation, and with their contemporary peoples in other parts of

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*In this article the following are the chief abbreviations used:

AF:	*Issledovaniya po Arkheologii SSSR* (Artamonov Festschrift), Leningrad 1961.
AK:	*Arkheologiya*, Kiev (in Ukrainian, mostly with a short summary in Russian).
AO:	*Arkheologicheskiye Otkritiya*, Moscow.
AP:	*Arkheologichni Pamyatky URSR*, Kiev (in Ukrainian, mostly with a short summary in Russian).
ASE:	*Arkheologicheskii Sbornik*, Hermitage, Leningrad.
KSIAK:	*Kratkie Soobshcheniya Instituta Arkheologii*, Kiev.
KSIAM:	*Kratkie Soobshcheniya Instituta Arkheologii AN SSSR*, Moscow.
KSIIMK:	*Kratkie Soobshcheniya Instituta Materialnoy Kultury*, Moscow.
MDAPV:	*Materialy i Doslizhdeniya po Arkheologii Prykarpattya i Volyni*, Kiev (in Ukrainian, mostly with a short summary in Russian).
MIA:	*Materialy i Issledovaniya po Arkheologii SSSR*, Moscow-Leningrad.
MKE:	*Materialy Khorezmskoy Expeditsii*, Moscow.
NSA:	*Novoe v Sovetskoy Arkheologii* (*MIA* 130), Moscow 1965.
PEB:	*Pamyatniki Epokhi Bronzy Iuga Evropeyskoy Chasti SSSR* (Terenozhkin Festschrift), Kiev 1967.
Rapports:	*Les Rapports et les Informations des Archeologues de l'URSS, VI Congrès International des Sciences Préhistoriques et Protohistoriques*, Moscow 1962 (mostly in French; some articles in English).
SA:	*Sovetskaya Arkheologiya*, Moscow.
SAS:	*Sibirskii Arkheologicheskii Sbornik*, Novosibirsk.
SVOD:	*Svod Arkheologicheskikh Istochnikov. Arkheologiya SSSR*, Moscow-Leningrad.
TIIAEK:	*Trudy Instituta Istorii, Arkheologii i Etnografii Akademii Nauk Kazakhstanskoy SSR*, Alma-Ata.

1. *Bulletins* No. 6 for 1966 and No. 7 for 1968 of the Institute of Archaeology (pp. 94–129 and 43–83 respectively).

the U.S.S.R., being very voluminous, has been deferred to the next report; its inclusion would greatly lengthen the volume of the present report.

It should be emphasised that a series of publications quoted in my second report, on the Bronze Age of the U.S.S.R., often relates partly to the period under review and I have to refer to these. The arrangement of the present account follows the same scheme that was applied to the two former reports.

Publications of a general character

Only a few books in this category may be mentioned here. One of these is *Arkheologiya Starogo i Novogo Sveta* (*The Archaeology of the Ancient and New Worlds*), Moscow 1966, 296 pages by various authors; edited by N. Ia Merpert and P. M. Kozhin). It aims at giving a series of short reviews of the outstanding problems in the archaeology of various parts of the whole world. Out of seven contributions dealing with the prehistoric past of Europe, only two relate to Eastern Europe, one by D. A. Machinskii (pp. 82–96) devoted to the last centuries B.C. of the country on the Dniester, and the other, by O. Bahder (pp. 135 ff.) in which some Transcaucasian problems have been discussed. The article by V. I. Gulyalev (pp. 251–269) is concerned with Asiatic influence on ancient Central American civilisation. Another book, *Arkheologiya SSSR* (*Archaeology of the U.S.S.R.*, Moscow 1967, 292 pages, 115 figures, Vysshaya Shkola) by D. A. Avdusin is a manual for students of the historical faculties at the universities and institutes of higher education. It gives a concise account of the development of man and his culture within the confines of the U.S.S.R. from the Palaeolithic to the 15th century A.D. but concentrates mainly on the European part of the country. The volume *Historische Schätze aus der Sowjet-Union* (Essen 1967, 122 pages, 66 plates, 19 of them coloured) may also be mentioned. This is a catalogue of the exhibition of the prehistoric art of the Soviet Union at Villa Hügel in Essen-Bredenay in August 1967, and contains a brief review of the archaeology of the U.S.S.R. by twelve Soviet scholars (pp. 13–60), preceded by an introduction by A. L. Mongait. Here also belongs my recently published book, *Prehistoric Russia* (John Baker 1970, 449 pages, 51 plates, 91 figures, 32 maps, 23 tables), which deals with the prehistoric past of Eastern Europe from the Palaeolithic up to the end of the seventh century BC, to the Scythian conquest of the North Pontic area.

A general review, written by many authors, of the achievements of Soviet archaeology during the last fifty years appeared in *SA* 1967 (3) (pp. 5–141) and 1967 (4) (pp. 5–145). The first of these contains articles devoted to research in Russia proper, the Ukraine, Bessarabia, Estonia, Lithuania, Tadzhikstan and Turkmenia; the other relates to Georgia, Armenia, Azerbaijan, Kazakhstan, Kizgiz SSR, Uzbekistan, Latvia and Byelorussia. Special articles in *SA* 1967 (4) (pp. 146–163) and *SA* 1968 (3) (pp. 85–100) by L. V. Alekseev are devoted to the history of the pre-revolution development of archaeological research in

Byelorussia. A similar review of the achievements of archaeological research of the last 50 years in the Ukraine by S. M. Bibikov appeared in *AK* XXI, 1968, pp. 3–35. Finally, M. Iu. Smishko devoted an article to the history of archaeological investigations in the western part of the Ukraine, seized in 1939 from Poland, during the period 1940–1958 (*MDAPV* (2) 1959, pp. 5–28).

Of importance is the book *Sovetskaya Arkheologicheskaya Literatura, 1918–1940* (*Soviet Archaeological Literature 1918–1940*, Moscow-Leningrad 1965, 376 pages) by four authors, N. A. Vinberg, T. N. Zadneprovskaya, R. S. Levina and A. A. Lyubimova. The bibliography is arranged in the geographical order of the several regions of the U.S.S.R. in Europe and in Asia, each subdivided into chronological groups according to the theme of the publications. A special section is devoted to publications outside the U.S.S.R. and a list of periodicals is added. There are two indexes, one of the personal names of authors, the other of cultures dealt with in the relevant literature.

Of a rather general character are two books devoted to the palaeoanthropology of the U.S.S.R. One of these is the volume *Contributions to the Physical Anthropology of the Soviet Union* (Russian Translation Series, Peabody Museum, Cambridge, Mass. 1960, introduction by H. Field). For our study the three most important chapters are chapter II, by M. G. Abdushelishvili, a review of the anthropological material from the Samtavro cemetery in Transcaucasia; chapter V, by the same author (pp. 81 ff.) which contains a summary of the results of the study which shows that people buried in the cemeteries Samtavro I and II (10th to 8th centuries B.C.) were related to the peoples of Asia Minor: and in chapter X (pp. 128 ff.) S. S. Chernikov describes sites, settlements and cemeteries of the Bronze Age and the Early Iron Age in Eastern Kazakhstan (the 9th to 8th centuries B.C.), and of the Saco-Scythian period, and discusses the results of anthropological study of the cranial material from these. The other book, *Ocherki Paleoantropologii Ukrainy* (*Essays on the Palaeoanthropology of the Ukraine*, Kiev 1967, 223 pages, 14 tables) by G. P. Zinevich, brings the results of the author's study of the cranial material of the Ukraine from the Neolithic to the Middle Ages. A reconstruction of the process of the formation of the several anthropo-ethnic groups that lived in the Ukraine during the prehistoric past has been attempted.

An article by Iu. M. Zakharuk (*AK* XVII, 1964, pp. 12–42) relating to methods in archaeological research was not mentioned in my second report (*Bulletin* 7, p. 49). The notion of an archaeological culture, the question of the attribution of the various cultures to some defined ethnic groups, and topics connected with changes in the contents of the cultures during their development, have been discussed. The article is illustrated by a number of graphs. The question of applying cybernetic methods to the solution of some archaeological problems has been discussed by M. Iu. Braichevskyi (*AK* XXI, 1968, pp. 36–49). Finally, I. L. Nogid and A. I. Pozdnyak (*SA* 1965 (3), pp. 277–279) discuss methods of

preservation of wet wooden objects. V. A. Malevannyi (*SA* 1968 (4), pp. 224–233) publishes the results of chemical analyses of 41 samples of pigments taken from a number of prehistoric objects of various ages from different parts of the U.S.S.R. (Table 2, pp. 228–230), and discusses the results which imply the local origin of all pigments. He also emphasises that the results suggest that the technical knowledge and skill in this respect was then in Eastern Europe practically on the same level as in Egypt and Rome in the same periods.

Of special importance is the report by A. A. Sementsov, E. N. Romanova and P. M. Dolukhanov (*SA* 1969 (8), pp. 251–261) producing the results of Carbon 14 determination of a large number of archaeological samples from various parts of the U.S.S.R., done by the Laboratory LOIA (Leningrad branch of the Institute of Archaeology of the Academy of Sciences of the U.S.S.R.)

Economy

The work *Drevnee Zhivotovodstvo Plemen Vostochnoy Europy i Sredney Azii* (*Ancient Stock-breeding by the East European and Central Asiatic Tribes*, *MIA* 135, 1966, 159 pages) by V. I. Tsalkin is devoted to the study of the development of breeding domestic animals. The author also tries to distinguish the races of the animals kept in different parts of the whole territory under review during the time from the 9th century B.C. to the 5th century A.D. His results, based on the material from over 80 settlements, and from many graves and cemeteries, imply that the relation of hunting and breeding of domesticated animals for the provision of meat diet was different in various periods in different parts of the whole territory. This is illustrated by several graphs. Bones of wild animals prevail in sites of the forest zone, whereas in the steppe mostly domesticated animals had provided meat. The same results were published by the same author (*KSIAM* 101, 1964, pp. 24–30), restricted to the conditions in the late second and early first millennia B.C. in the country on the middle Volga. Over 44,500 bones of nearly 3,000 individual animals were investigated.

Two types of early agriculture in the forest zone of Eastern Europe have been discussed by Iu. A. Krasnov (*SA* 1967 (1), pp. 3–21), one based on tilling the soil, the other on burning out plots in the woods for seeding cereals (*Brandwirtschaft*). The use of both techniques is attested by archaeological and ethnographic data and historical records. The earliest traces of agriculture in that zone go back to the mid-second millennium B.C. A. M. Negrul (*SA* 1960 (1), pp. 111–119) discusses finds of grape seeds in the U.S.S.R. The results of the study, shown on three tables, imply that the earliest seeds, of the third millennium B.C., have been found at Namazga Tepe in Central Asia and in Georgia in Transcaucasia. In the first millennium, vines were cultivated in several areas in Soviet Central Asia, in Transcaucasia and in the Crimea. The book *Vozniknovenie i Razvitie Zemledeliya* (*The Origin and Development of Agriculture*, Moscow 1967, 232 pages, 72 figures. Editors V. D. Blavatskii and

A. V. Nikitina) by four authors was reviewed by Iu. A. Krasnov, G. N. Lisitsyna and A. V. Chernetsov (*SA* 1969 (1), pp. 288–293 and 293–297). The book discusses first the theories of N. I. Vavilov relating to the earliest (original) centres of agriculture in various parts of the whole world, then the archaeological traces of the earliest agricultural activities in Europe and in the countries of other continents are dealt with, but the further development and spread of agriculture—up to the 15th century A.D.—has been studied only within the territory of the U.S.S.R.

Mention must also be made of an article by B. B. Piotrovskii (*SA* 1968 (1), pp. 20–27) in which ancient imported Egyptian objects found within the confines of the U.S.S.R. have been listed, described and dated. The earliest specimen is a scarab of the 18th Dynasty found in the Urartian centre Argishtikhinili in Armenia; it was of the 8th century B.C. Scarabs of the period 7th to 5th centuries B.C. and other objects of the same period were also found in the North Caucasus, in the southern part of the Ukraine, and in Samarkand in Central Asia. The list also contains objects of later periods, up to the end of the Roman period.

Metallurgy

Topics connected with the development of ancient metallurgy and mining in the U.S.S.R. in the second millennium B.C. were the theme of a special paragraph in my second report (*Bulletin* 7, pp. 46–49). However, some of the articles reviewed there deal also with the metallurgy of the early first millennium B.C. This relates especially to the contribution by A. M. Leskov (*PEB*, pp. 143–178) on the Ukrainian Bronze Age; to the work of B. G. Tikhonov (*MIA* 90, 1960) dealing with the metallurgy of the Middle Urals and the country between the Urals and the Volga; and also to the work by E. E. Kuzmina (*SVOD* B-4-9, 1966) on the development of Central Asiatic metallurgy, the third period of which fell in the 12th to 8th centuries B.C. On the other hand the study by A. I. Kashtanov and A. P. Smirnov (*KSIIMK* 72, 1958, pp. 3–13) in which the results have been published of the spectrographic analysis of bronze objects found in the eastern and northern parts of Russia proper was overlooked; the authors emphasised the eastern origin of the material of the bronze objects of the first millennium B.C. found within the territories of the Karelian and Kargopol cultures in northern Russia; the bronze used in the Middle Urals differed from that of the region on the Kama.

E. A. Symonovich (*SA* 1968 (1), pp. 127–142) describes the recently uncovered bronze hoard of the 11th to 8th centuries B.C. on the river Ingul, north of Kherson, in the Ukraine, and E. N. Chernykh (as above, pp. 143–155) produces the results of its spectrographic analysis; the copper used was mostly of Balkano-Carpathian origin. B. A. Shramko, L. A. Solutsev and L. D. Fomin (*SA* 1963 (4), pp. 36–57) produce the results of their study of iron

objects found in the forest-steppe zone of ancient Scythia (the Ukraine) of the 8th century B.C. and conclude that iron weapons and tools were manufactured mainly by various methods of hammering.

E. E. Kuzmina (*PEB*, pp. 214–216) deliberates on an important bronze hoard of the final stage of the Bronze Age found at Predgornoe on the Irtysh near Ust-Kamenogorsk in East Kazakhstan. Its Uralo-European analogies raise the question of the reciprocal relations between the steppe population of the distant regions of the Eurasiatic steppe belt. Traces of copper mining in Tuva, in the Altai Mountains, in the time from the 12th to 3rd centuries B.C. have been studied by Ia. I. Sunchugashev (*SA* 1966 (4), pp. 187–191), who also produces the results of the analysis of copper slag from a number of points investigated by him. The same author reports on his investigation of copper mines in the same region (*SA* 1964 (3), pp. 301–306), and describes the pottery and implements found there on the spot; the mines were active in the 5th to 3rd centuries B.C.

Art

Several articles were devoted to petroglyphs in various areas of the U.S.S.R. New Karelian petroglyphs were described by Iu. A. Savvateev, *Risunki na Skalakh* (*Drawings on Rocks*, Petrozavodsk 1967, 166 pages). They have been dated to the turn of the second and first millennia B.C. Another group of Karelian petroglyphs, at Novaya Zalavruga on the White Sea, has been studied by the same author (*SA* 1968 (1), pp. 134–157). They form 122 distinct groups and are dated from the early third millennium to the turn of the second millennium B.C. Their discontinuance was probably due to tribal migrations of that period. The author discusses the meaning of the petroglyphs and also the difference between those of the White Sea and Lake Onega groups, which undoubtedly denote two different ethnic assemblages.

Petroglyphs called 'Bolshaya Boyarskaya Pisanitsa' in Siberia, are the theme of a special study by M. A. Devlet (*SA* 1965 (1), pp. 124–142), who dates them to the end of the second and the first half of the first millennium B.C. Those called Kaskabulak in eastern Kazakhstan, of the pre-Sacian period of the 7th to 5th centuries B.C. have been dealt with by V. E. Sokolov (*SA* 1964 (3), pp. 199–204). Finally, P. N. Smirnov (*SA* 1965 (3), pp. 280–282) describes the method of recording the incised petroglyphs by impressing a plastic matrix on them.

An article by L. P. Khlobistyn (*KSIAM* 101, 1964, pp. 35-37) should be mentioned, in which the author deliberates on the meaning of stone figurines of fishes and seals, especially of the 'nerpa', a Baikal Sea seal, a large number of which have been found in Siberia. He points out that many of these had evidently a sacral meaning, which is attested by a specimen recently found: this was a well-polished nefrite to which the shape of a phallus has been given

and a drawing of a nerpa seal engraved on it. The object was found in a cave at a site on the north-western corner of the Baikal Sea, in a layer of the first millennium B.C.

The early first millennium in the South-West

Conditions in the Ukraine settled late in the second millennium B.C. during the Late Bronze Age did not change until about the 8th century B.C. The new order established then, mainly in the country west of the Dnieper, lasted to the Scythian conquest at about the turn of the 7th and 6th centuries B.C. The cultures and events of the late second millennium and of the 'pre-Scythian' period are the theme of the book *Predskifskii Period na Dneprovskom Pravoberezhie* (*The Pre-Scythian Period in the Country West of the Dnieper*, Kiev 1961, 248 pages) by A. I. Terenozhkin and have also been discussed in a series of articles by the same author and by S. S. Berezanska, V. D. Rybalova and others; they were all quoted in my second report (*Bulletin* 7, pp. 56–59). The paperback *Drevnie Frakiytsy v Severnom Prichernomorie* (*Ancient Thracians in North Pontic Lands*, Moscow 1969, *MIA* 150, 192 pages) is of interest. It contains eight articles by nine authors, dealing with the Thracian peoples who from the late second millennium B.C. to the late second century A.D., lived in the country on the Dniester; elements of their culture have been found farther east, up to the Dnieper and in the Crimea.

The book *Arkheologicheskie Issledovaniya na Ukraine 1965–1966* (*Archaeological investigations in the Ukraine 1956–1966*, Kiev 1967, 242 pages) contains 56 brief reports on recent archaeological investigations and surveys in the Ukraine, including the Crimea, by over 60 authors, arranged in the chronological order of the remains. A few reports relate to the Late Bronze Age and the pre-Scythian period. O. G. Shaposhnikova reports on the investigation of a settlement at Rozdolnoe in the south-eastern Ukraine (pp. 87 ff.), and A. V. Bodyanskii and I. N. Sharafutdinova (pp. 90 ff.) give a brief account of the investigation of a Late Bronze Age foundry, of the 10th to 9th centuries B.C., uncovered at Zlatopol in the region of the Dnieper Rapids. A few other reports by several authors contain very brief information on their surveys of the region extending along the larger Ukrainian rivers and in the Crimea; traces of a number of Late Bronze Age and pre-Scythian settlements have been recorded (pp. 196–223).

Western Podolia and Western Volhynia

Three articles have been devoted to the Holihrady culture of the early Iron Age of West Podolia and northern Bucovina. G. I. Smirnova (*KSIAM* 105, 1965, pp. 109–118) describes the results of the excavation of a settlement of the culture at Mahala near Chernovtsi in the Bucovina and discusses the chronology of the culture. I. K. Sveshnikov in a special article (*MDAPV* 5, 1964, pp. 40–66) characterizes the culture, its pottery and bronzes, most of which

MAP I (for numbered sites see list opposite)

1 Dereviannoe
2 Złoczów
3 Michałków
4 Mahala
5 Alchedary
6 Anatolevka
7 Tudorovo
8 Bolgrad
9 Inkerman
10 Balka Ashlama-Depe
11 Simferopol
12 Peresadovka
13 Zmiivka
14 Zavadovka
15 Zolota Balka
16 Nizhniy Rogachik
17 Zlatopol
18 Velyka Andrusivka
19 Subbotov
20 Nosachevo
21 Kolomishchyna
22 Chisalovka
23 Butenki
24 Belgorod
25 Oskol
26 Rozdolnoe
27 Novocherkassk
28 Kobyakovo
29 Gelendjik
30 Inzhichukun
31 Zmeyskaya
32 Rutkha
33 Tli
34 Serzhen-Iurt
35 Lugovoe
36 Khorochoy
37 Kayakent
38 Samtavro
39 Ude
40 Kazakh (Sary-Tepe)
41 Karmir Blur—Teishebaini
42 Erebuni—Erevan
43 Argishtikhinili
44 Mingechaur
45 Khodjala
46 Aksay
47 Rovnoe
48 Khvalinsk and Demkino
49 Komarovka
50 Novo-Mozdovo
51 Chebarkul
52 Bor
53 Vasyukovskaya
54 Lugovskaya
55 Akhmylovo
56 Vasilsurskoe
57 Ziravkino
58 Briansk
59 Olskii Mys

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were found in hoards, settlements and graves, and establishes the extent of the territory covered by the finds of the Holihrady culture, and its date, the 10th to 7th centuries B.C. The same author, in another article (*SA* 1968 (1), pp. 10–27) deliberates on the symbolism of the objects from the golden hoard of Michałków on the Dniester, which belonged to the Holihrady culture. He points out that symbolism concerned with the goddess of fertility connects the hoard with the ancient Oriental civilization, but other symbols are closely linked with the sun worship of the Carpatho-Danubian area. He is of the opinion that the hoard was hidden *c.* 650 B.C.

A few other articles deal with the Wysocko culture, the area of which extended further north, including western Volhynia. Iu. V. Kukharenko (*KSIAM* 107, 1966, p. 113) reports on the north-easternmost find of the culture, a burial uncovered at Dereviannoe west of Równe, and L. I. Krushelnytska (*AK* XIX, 1965, pp. 122–135) gives account of the investigation of a cemetery of the culture at Złoczów, dated by her as the 8th to 7th centuries B.C. Mention should also be made of a larger study devoted to the Wysocko culture by Z. Bukowski (*Archeologia Polski* XI, 1966, pp. 28–106; in Polish with a summary in English).

His view that the culture forms a local branch of the Lusatian culture cannot be justified and the final date proposed by this author, the beginning of the Scythian period *c.* 600 B.C., does not seem to be well founded. Arrow-heads of the Scythian type and 'Scythian' personal ornaments found in several graves of the culture imply its existence at least during the Early Scythian period, until about the end of the 5th century B.C.

Bessarabia

The circumstances in Bessarabia during the early first millennium have been discussed by A. I. Meliukova in her two larger works, *Pamyatniki Skifskogo Vremeni Lesostepnogo Podnestrovia* (*Remains of the Scythian Period in the country on the Middle Dniester*, *MIA* 64, 1958, pp. 5–102), and the other, already quoted in my second report (*Bulletin* 7, p. 59), *Kultury Predskifskogo Perioda v Lasostepnoy Moldovii* (*Cultures of the Pre-Scythian Period in the Forest-Steppe Zone of Moldovia*, *MIA* 96, 1961, pp. 5–52).

A few articles contain reports on recent investigations. Of some interest are slab-cist graves of the pre-Scythian period (7th to 6th centuries B.C.) uncovered at Alchedary near Rezina, investigated by A. L. Nikitin and V. I. Levin (*KSIAM* 103, 1965, pp. 75–78). A. I. Meliukova (*KSIAM* 84, 1961, pp. 113–124) publishes the results of her survey in the region on the lower Dniester. Traces of 31 ancient settlements have been recorded but only four of these were of the pre-Scythian period, all others being of later periods. Of importance were the results of excavation of the earthwork Tudorovo I. Its upper layer was of the 2nd to 3rd centuries A.D. and the lower one of the 4th to 3rd centuries B.C. However, the character of the remains found in the lowest stratum links them closely with those of the late Srubnaya culture of the final Bronze Age in the North Pontic steppe, although they also exhibit many local features. The author is of the opinion that they were of the post-Sabatynivka period, of the 9th to 8th centuries B.C., and must have belonged to a population closely related to its coeval peoples of modern Rumania, differing from the steppe dwellers. Finally a settlement of the early first millennium B.C., of the late Bronze Age, has been investigated by I. T. Chernyakov (*KSIAM* 106, 1966, pp. 99–105) at Bolgrad in the southernmost part of Bessarabia.

The country on the Dnieper

A settlement, situated between the rivers Dnieper and the Tyasmin, of the late Bilohrudivka culture of the 9th to 8th centuries B.C., the end of the Bronze Age, has been excavated at Velyka Andrusivka. According to its investigators, E. F. Pokrovska and E. O. Petrovska (*AK* XIII, 1961, pp. 129–144), the inhabitants must have had connections with the people of the late Srubnaya culture on the other side of the Dnieper. Of particular interest is an unusual find of a few cremations uncovered on the site of the Tripolyan settlement

Kolomishchyna I reported by T. G. Movsha (*NSA*, pp. 204–206). The burials were of the 8th and the first half of the 7th centuries B.C., of the period of the Chornii-Lis culture in the Ukraine.

More intensive investigations have been undertaken further south where several settlements of the Sabatynivka culture have been excavated. Some of these, within the valley of the lower Dnieper, have been briefly described by I. M. Sharafutdinova (*AP* X, 1961, pp. 12–25); a map, fig. 1, shows their position. They were of the period from the 11th to 8th centuries B.C. In the same volume (pp. 26–39), the results of investigation of one of the settlements of that area, at Zmiivka near Kakhivka, have been described by A. V. Burakov, and those of the settlement and cemetery at Nizhniy Rogachik by D. T. Berezovets and S. S. Berezanska (pp. 40–47).

Several barrow graves and flat cemeteries have also been investigated in the valley of the lower Dnieper; they were reported by nine authors (*AP* IX, 1960). The burials were mostly of the second millennium, several were of the Srubnaya culture, but also a number of burials of the early first millennium B.C. could be distinguished. A similar cemetery was investigated by M. I. Vyazmitina at Zolota Balka (*AP* X, 1961, pp. 64–74).

Most settlements mentioned above formed part of the Sabatynivka culture, which extended over the steppe zone west of the Dnieper. I. N. Sharafutdinova, in a special article (*SA* 1968 (3), pp. 16–32) discusses the origin of the culture and distinguishes two stages in its development (the 13th to 11th centuries and 10th to 8th centuries B.C.). The results of investigation of a number of settlements of the culture outside the valley of the lower Dnieper have been published by several authors. Thus B. N. Grakov and A. I. Terenozhkin report on excavation of the stratified earthwork at Subbotov (*SA* 1958 (2), pp. 164–178) destroyed in the 8th century B.C. and N. N. Pogrebova (*SA* 1960 (4), pp. 76–90) discusses the results of investigation of the settlement at Peresadovka on the Ingul, set up around 800 B.C., which survived to the Scythian period. The same author, jointly with L. V. Kondratskii (*KSIIMK* 78, 1960, pp. 74–84) gives account of investigation in the area south-west of Nikolaev, during which traces of several settlements of the pre-Scythian period, of the 10th to 7th centuries B.C., have been recorded. One of these, at Anatolevka on the Tiligulskii Liman, was partly excavated and the report has been published by N. N. Pogrebova jointly with N. G. Elagina (*KSIAM* 89, 1962, pp. 6–14); the settlement was in existence in the 9th and 8th centuries B.C. A report on surveys of the country along the river Ingul, accompanied by a map of about 50 sites recorded, has been published by N. N. Pogrebova jointly with N. G. Elagina (*KSIIMK* 77, 1959, pp. 21–34); the sites were mostly of the pre-Scythian period, but there were also many of later periods. Fifteen groups of barrow graves and about 40 isolated mounds have been recorded. A new bronze foundry of the early first millennium B.C., found at Zavadovka on the Kakhovka water reservoir, has

been published by A. M. Leskov (*KSIAM* 103, 1965, pp. 63–65). Another one, at Zlatopol in the region of the Dnieper Rapids, of the 10th to 9th centuries B.C., was investigated by A. V. Bodyanskii and I. N. Sharafutdinova, as already mentioned above.

Finally, B. A. Latynin (*ASE* 6, 1964, pp. 53–71) discusses the question of the so-called 'mnogovalikovaya' pottery, pottery decorated with several raised bands around the body of the vessels (see my second report, *Bulletin* 7, p. 57), and concludes that it cannot be regarded as a feature characteristic of a distinct culture; the pottery must be looked upon as one of the varieties of the pottery proper to the Srubnaya culture of the Ukraine of the late second and early first millennia B.C. This conclusion does not seem correct.

The Crimea

Topics connected with the Crimean prehistoric past, from the Palaeolithic to the 7th century B.C., have been dealt with in the book *Istoria i Arkheologiya Drevnego Krima* (*History and Archaeology of Ancient Crimea*, Kiev 1957, 336 pages). It contains 23 contributions by 22 authors, some of which relate to the first half of the first millennium B.C. Among these are two reports by Kh. I. Kris, one on the investigation of the settlements of the Kizil-Koba culture at Balka Ashlama-Depe (pp. 40–46) and the other one on an early Taurian settlement of the 7th to 6th centuries B.C. at Inkerman (pp. 47–52). Another article, by V. V. Bobin (pp. 54–60) is devoted to discussion of the resemblance of the Crimean to the north Caucasian culture of the transitional period from the Bronze to the Iron Ages. On the other hand, Kh. I. Kris, in another article (*SA* 1961 (4), pp. 66–77) distinguishes two periods in the development of the Kizil-Koba culture, one from the 8th century to *c.* 600 B.C. and the other contemporaneous with the Scythian period of the Ukraine, lasting until the 4th century B.C.; he dismisses theories of the Caucasian origin of the culture.

The Kizil-Koba culture was succeeded by the Taurian culture to which the book *Gornyi Krym v Pervom Tysyacheletii Do N.E.* (*The Crimean Highlands in the first millennium B.C.*, Kiev 1965, 200 pages) by A. M. Leskov has been devoted. Three subsequent periods in the development of the culture have been distinguished, lasting from the 9th to the 1st centuries B.C., and the characteristic remains of each of these have been shown in a special chronological graph (pp. 96–97).

A number of articles report on the excavation of settlements and burials of the early first millennium B.C. To these belong articles in the book mentioned at the beginning of this section by A. A. Shchepinskii and E. N. Cherepanova (p. 30); A. M. Leskov (p. 34 f.); and by V. N. Korpusova (pp. 38 ff.). A preliminary report of the investigation of a settlement of the Kizil-Koba culture at Simferopol was published by O. D. Dashevskaya (*SA* 1958 (3), pp. 193–197). Investigations in the Inkerman valley, south-east of Sevastopol, have been

published in a special volume (*AP* XIII, 1963). Settlements and graves investigated were mostly of later periods, but some were of the early first millennium B.C. A general review of the results was given by N. P. Katsur (pp. 7–14). A. A. Shchepinskii and E. N. Cherepanova (*AO* 1966, pp. 179–183) give account of their investigations in various parts of the Crimea of several sites and burials of various ages. Over 20 mounds containing over 130 burials of different periods were excavated. Many were Srubnaya burials, almost exclusively secondary interments and at least some of them were of the early first millennium. They were also found in the south of the Crimea alongside those of the Kemi-Oba culture. A considerable number of sites have been recorded in the Crimean steppe which implies that the country was well populated during the time from the third millennium to mid-first millennium B.C. A. M. Leskov (*AO* 1966, pp. 183–185) emphasizes that there were similar conditions in the eastern part of the Crimea. His investigations revealed that the Kemi-Oba culture (the 'dolmen' culture) formed only a western branch of tribes who lived along the Black Sea coast in the north-west Caucasus. The 'dolmen' culture in both countries survived to the early first millennium B.C. The same author (*SA* 1961 (1), pp. 259–266) points out that the non-Greek pottery of the 6th to 5th centuries B.C. found in the lowest layer at Nimphaea and also in other sites of the area, was early Taurian, not Scythian as usually maintained.

Finds of Novocherkassk type

Three richly-furnished graves, evidently of local chieftains, have been recently uncovered. One of these was a secondary burial in a slab-cist in a barrow grave at Simferopol in the Crimea, published by A. A. Shchepinskii (*KSIAK* 12, 1962, pp. 57–65). It yielded a fine elaborate bronze horse harness of the Novocherkassk type. This was probably the grave of a member of the pre-Scythian aristocratic chariotry. A similar burial furnished with a horse harness of the same type has also been uncovered at Butenki in the basin of the Vorskla near Poltava in the Ukraine. It has been published by G. T. Kovpanenko (*KSIAK* 12, 1964, pp. 66–72). The same author also published a new find of a similar set of horse harness of the 8th to 7th centuries B.C., originating from a barrow grave at Nosachevo near Smila in the Ukraine west of the Dnieper (*AK* XX, 1966, pp. 174–179). In this context my article 'The Cimmerian Problem' (*Bulletin* 2, 1959, pp. 45–64) may be mentioned.

To the same group belongs the so-called hoard from Aksay (a town between the lower Don and the Volga, south-west of Stalingrad), discussed by A. N. Melentiev (*KSIAM* 112, 1967, pp. 38–44). It consisted of two pairs of bronze bits and parts of bronze harness of the 8th to 7th centuries B.C., of the 'Cimmerian period', which lay on an iron socketed lance-head. The 'hoard' was found during the excavation of a large barrow grave called 'Gireeva Mogila', which contained three burials, two of these with horses. The Carbon 14 date of

one of the graves is 1920±120 B.C. (RUL-136). The hoard did not belong to any of the graves. It implies the use of horse-drawn chariots (or perhaps four-wheeled carts) by the local chiefs in the pre-Scythian, 'Cimmerian', period. Finally, a number of bronze objects, bone cheek-pieces and an iron sword with a haft of north Caucasian type, all of the Early Iron Age, the 8th to 7th centuries B.C., were found in the environs of Khvalinsk on the lower Volga, and at Demkino in the same region (the sword). All these objects have been published by E. K. Maksimov (*SA* 1963 (3), pp. 282–288).

The country east of the Dnieper

The Bondarykha culture was among the most important cultures of the early first millennium in the forest-steppe zone east of the Dnieper. It has been briefly dealt with by V. A. Ilinskaya (*SA* 1961 (1), pp. 26–45), who likewise discusses there the reciprocal relations between the culture and the coeval cultures bordering on it, and also its gradual absorption, in the 6th century B.C., by the Scythian culture. The same author (*KSIAK* 8, 1959, pp. 80–84) published a short preliminary report on the excavation of a settlement of the Bondarykha culture at the village Oskol on the river Oskol near Izium; a bronze dagger and an iron knife were found there. The settlement has been considered to date from the Chornolis period, the 8th century B.C. Another settlement of the same culture has been investigated by A. F. Evminova (*KSIAK* 11, 1961, pp. 84–86) near Belgorod near the sources of the Donets, outside the boundaries of the Ukraine.

P. A. Liberov (*KSIAM* 83, 1961, pp. 95–103) gives account of the surveying of the valley of the lower Oskol (a tributary of the Donets) in the region of Izium and Kupiansk. Traces of 41 settlements of the Bronze Age and Early Iron Age have been recorded, several of which were of the early first millennium B.C. They lay on the border of the forest-steppe and steppe zones, on the boundary between the settled and nomad peoples.

It may be mentioned that the Carbon 14 date (*SA* 1969 (1), p. 255) of charcoal excavated in a settlement at Chisalovka, near Poltava, is 660 B.C. (LE-413), whereas the settlement has been considered (I. N. Sharafutdinova) to be dated to the beginning of the first millennium B.C.

The South-East

I. I. Lapushkin (*MIA* 62, 1958, pp. 227–262) describes his investigation of several sites and of three settlements of the Bronze Age, of the late second and early first millennium B.C., within the area subsequently submerged by the so-called Tsimlanskoe Lake on the lower Don.

The results of excavation of the important earthwork of Kobyakovo in the delta of the Don have been published in several reports by E. S. Sharafutdinova. The first of the series is that in the publication *Arkheologicheskie Raskopki na*

Donu (Rostov-on-the-Don, 1962, pp. 40–51) in which its date has been established as the 10th to 8th centuries B.C. The next was in *KSIAM* 93, 1963 (pp. 58–62), and then *KSIAM* 103, 1965 (pp. 58–62), in which she deliberates on a stone mould for casting socketed axes of the 'Cimmerian' type and on chisels found in the earthwork. Investigations in 1962 were reported in *KSIAM* 112, 1967 (pp. 75–81) in which she points out that pottery found in semi-pit dwellings, and a bronze knife, date the settlement to the period from the 10th to 8th centuries B.C. Actually the Carbon 14 date of the samples of charcoal from the occupation layer of the earthwork is 670 B.C. (LE-406), with another date given as 900 B.C. (RUL-105).

A large portion of burials uncovered in barrow graves and of other remains excavated in the country on the lower Volga, considered to be of the Bronze Age, were of the early first millennium B.C. They were described in a series of articles by several authors in the volumes of *MIA* 60, 1959; 61, 1958; and 78, 1960, dealt with in my second report (*Bulletin* 7, pp. 62 f.). One of the cemeteries, at Rovnoe on the Volga, has been described by I. V. Sinitsyn (*KSIAM* 84, 1961, pp. 91–102); graves of the early first millennium have been discussed in pp. 98 f.

The time at which the steppe country on the lower Volga was reclaimed has been discussed by I. P. Shilov (*ASE* 6, 1964, pp. 86–102). The author shows that the Catacomb and Poltavka peoples of the Bronze Age kept mainly to the vicinity of rivers, and it is only by the end of the second millennium and early in the first millennium B.C. that the Srubnaya people gradually moved deep into the steppe. Their expansion into the grassland was the outcome of the adoption by the Srubnaya tribes of a purely pastoral economy.

The North Caucasus

An important book on North Caucasian archaeology of the Early Iron Age and the beginning of the Scythian period is *Drevnyaya Istoriya Severnogo Kavkaza* (*Ancient History of the North Caucasus*, Moscow 1960, 520 pages, 76 plates, 55 figures including maps, and a table of the main types of objects arranged into two chronological groups) by E. I. Krupnov. It deals chiefly with the remains of the central part of the North Caucasus, including the Koban culture, but also discusses conditions in other parts of the country and the relations of North Caucasian cultures of that time with those of Transcaucasia; the economy of the North Caucasian peoples of the period, their metallurgy, handicrafts, etc., have been considered. A kind of summary of the above book is an article by the same author, 'A propos de la chronologie de l'age du fer au Caucase Nord' (*Rapports* 1962, 13 pages). It deals mainly with the Iron Age cultures of the central part of the North Caucasus, the Koban culture in particular, and its north-eastern branch, the Kayakent-Khorochoi culture. A graph (pp. 14–15) shows the chronological position of the main cemeteries and important finds of the three periods distinguished in the develop-

ment of the time from 1100 to 400 B.C. Another article by the same author (*MIA* 68, 1958, pp. 176–195) is devoted to the problem of the Cimmerians in the North Caucasus; special types of bronze weapons have been attributed to them.

N. V. Anfimov (*NSA*, pp. 196–198) describes four daggers of the so-called Kabardino-Piatigorsk type found in the North-West Caucasus, the country on the river Kuban. The daggers of this type, the blade of iron, the haft in bronze open-work, are considered as characteristic of the western branch of the Koban culture in the western limits of the Central Caucasus. The four specimens above imply that they were known also farther west, in the Kuban country, and the author proposes to call them the North-Caucasian type.

The chronology and other topics connected with the central Caucasian highland cemeteries and the Koban culture have been discussed by several authors. V. A. Safranov (*KSIAM* 108, 1966, pp. 23–30), mentioned in my second report (*Bulletin* 7, p. 64), is of the opinion that the Rutkha cemetery immediately preceded the time of the formation of the Koban culture in the 11th century B.C. A newly-discovered slab-cist grave of the Koban period in the region west of the proper Koban territory, at Inzhichukun, has been described and discussed by E. P. Alekseeva (*SA* 1960 (2), pp. 236 ff.) and B. V. Tekhov, in a series of four reports (*SA* 1960 (1), pp. 163–178; 1961 (4), pp. 128–139; 1963 (1), pp. 162–178; and 1965 (2), pp. 142 ff.), gives account of the excavation of a larger cemetery of the Koban culture at Tli in southern Osetia, situated south of the main Caucasian ridge, on its Transcaucasian side, and deliberates on some important objects found there. The results of excavation of a settlement of the Koban culture at Stanitsa Zmeyskaya on the river Terek in northern Osetia have been published by D. V. Deopik and E. P. Krupnov in the book *Arkheologicheskie Raskopki v Rayone Zmeyskoy Severnoy Osetii* (*Archaeological excavations in the region of Zmeyskaya in north Osetia*, Ordzonikidze 1961, pp. 23–30).

The cultures of the north-eastern part of the North Caucasus have been described in a series of articles and a few books. One of these is an article by A. P. Kruglov (*MIA* 68, 1958, pp. 7–146) devoted to the north Caucasian Late Bronze Age, and in particular to the cemeteries of Khorochoi, Kayakent and Berekey. M. I. Isakov, in the book *Arkheologicheskie Pamyatniki Dagestana* (*Archaeological relics of Dagestan*, with a sub-title 'Materials for an Archaeological Map', Makhachkala 1966, 122 pages, 24 plates, 1 map) gives a list of all archaeological remains and sites of the time from the Palaeolithic to the early Middle Ages. The map is very useful; 1133 sites are listed on p. 94, arranged according to chronology. Recently a special study appeared, *Dagestan i Gornaya Chechnya v Drevnosti* (*Dagestan and the Upper Chechen Country in Antiquity*, Moscow 1969, *MIA* 122, 116 pages) by V. I. Markovin, devoted to the Kayakent-Khorochoy culture. The author discusses all its remains, the conditions under

which it developed and the chronology, and concludes that two stages may be distinguished in the development of the culture, the first in 1300–1100 B.C., the second 1100–900 B.C. The final date of the culture has hitherto been put at the 8th century B.C.

Several reports have been published on the excavation of the stratified settlement of Serzhen-Iurt I in Checheno-Ingushetia. There were two other ancient settlements in the same village. The earliest layer of occupation of site Serzhen-Iurt I was of the late third millennium B.C., of the Maikop culture of the Early Bronze Age, and the upper layer was of the early first millennium B.C., the 9th to 8th century B.C. Results of excavation in 1961 were reported by A. A. Yerusalimskaya, V. I. Kozenkova and E. I. Krupnov (*KSIAM* 94, 1963, pp. 42–53), according to whom the settlement was in existence up to the 7th century B.C. Next were reports by V. I. Kozenkova and E. I. Krupnov (*KSIAM* 98, 1964, pp. 73–80 and 106, 1966, pp. 81–87); by V. I. Kozenkova (*KSIAM* 103, 1965, pp. 67–74; 108, 1966, pp. 74–78; 112, 1967, pp. 82–89); V. I. Markovin and R. M. Munchaev (*KSIAM* 100, 1965, pp. 44–47); by E. I. Krupnov and others (*AO* 1966, pp. 59 ff.). *Radiocarbon* 7, 1965, p. 227 shows 1520 B.C. (RUL-258) and 1190 B.C. (RUL-265) for the lower layer and, according to A. A. Sementsov, E. N. Romanova and P. M. Dolukhanov (*SA* 1969 (1), pp. 256 ff.) 670 B.C. (LE-575), 910 and 940 B.C. (LE-661, LE-491) for the upper layer. It may be mentioned that the results of the pollen-analysis of the cemetery of Lugovoe in the north-east Caucasus, of the mid-first millennium B.C., and of similar remains in the same region, have been commented on by R. W. Fedorova (*SA* 1959 (1), pp. 286–290). Results of excavation of 50 graves of the 6th to 5th centuries B.C. of the cemetery of Lugovoe (at present renamed Muzhichi) have been published by E. I. Krupnov (*SA* 1958 (3), pp. 97–110). The cemetery consisted of 120 burials, including those above, which exhibit a great variety in their ritual (several contracted skeletons were uncovered) and in the construction of the graves (many with cairns or stone circles around them); they were mostly well-equipped with weapons and personal ornaments.

Caucasian relations with the Danubian basin in the Early Iron Age have been discussed by Gy. Gazdapusztai (*Acta Archaelogica Ac. Sc. Hungaricae* XIX, 1967, pp. 307–334), and the establishment of a chronological scheme attempted. The author does not take into account any of the more recent works on the theme by Soviet authors, including the work by A. I. Terenozhkin on the pre-Scythian period in the Ukraine, mentioned in one of the earlier paragraphs.

Transcaucasia

According to M. N. Pogrebova (*KSIAM* 89, 1962, pp. 22–29) some forms of Transcaucasian weapons, daggers and swords in particular, of the Early Scythian period in Transcaucasia, of the 8th to 7th centuries B.C., were a further development of the local Transcaucasian forms current there during the

preceding period, the 9th to 8th centuries B.C., the evolution of which may be traced back to the second half of the second millennium (Samtavro, Talysh, even Luristan). M. P. Griaznov (*KSIAM* 108, 1966, pp. 31–34) discusses the black-polished pottery of the Late Bronze Age in Transcaucasia, especially in the eastern part of the country and points to its similarity in shape, mark and, above all, in decorative patterns to pottery of the same period in Kazakhstan and Siberia. He concludes that the similarity was the outcome of the development of basic similar forms of vessels in similar economic and ecological conditions that prevailed at that time in all these areas. However, the only conclusion which can be drawn from the striking similarity, illustrated in a series of figures by the author, is that it was due to the migration of the eastern tribes, mainly of the Andronovo culture, who entered Transcaucasia and settled in its steppe area. The article 'A study of the palaeoanthropology of the Caucasus' (*Rapports*, 1962, 9 pages) by V. Alekseev, is concerned with the cranial material mainly from Transcaucasia from the Palaeolithic to the Early Iron Age, up to the 5th century B.C. Characteristics of the anthropological development and of the reciprocal relations between the main anthropological types have been discussed; they are not in agreement with the classification of the material (Samtavro) by M. G. Abdushelishvili mentioned in the first paragraph of the present report.

A large number of articles, and also books, are concerned with some parts of Transcaucasia only or contain preliminary reports on excavations. Thus the excavation of a slab-cist cemetery of the 7th–4th centuries B.C. at Gelenjik on the Black Sea coast has been published by I. I. Akhanov (*SA* 1961 (1), pp. 139–149); the cemetery lay at a distance of 500 m. from the Black Sea shore. The results of the spectrographic analysis of tin, bronze and iron objects of the hoard found at Ude in southern Georgia have been reported by S. N. Abesadze, R. A. Bakhtadze and T. A. Dvali (*SA* 1961 (3), pp. 166–177); the authors emphasize the high standard of iron technique reflected in the objects forming part of the find. Several objects of the hoard represent types characteristic of the Koban culture. G. A. Tiratsyan (*SA* 1964 (3), pp. 64–78) discusses some specific features of the culture of the 5th to 4th centuries B.C. of Transcaucasia, in particular of Armenia, in quoting and describing the relevant examples. Among the finds quoted are the cemeteries of Samtavro, Mingechaur, Djararat, the fortress of Erebuni near Erevan, etc. He points to close relations of the country with the Achaemenian Empire.

A series of reports relate to investigations in Azerbaijan. K. Kh. Kushnareva (*MIA* 67, 1959, pp. 376 ff.) describes the excavation of a barrow grave cemetery of the first half of the first millennium B.C. at Khodjala and points to connections with ancient Assyria reflected in its grave goods. According to G. M. Aslanov (*SA* 1961 (2), pp. 236–239) a grave of the beginning of the first millennium B.C. uncovered at Mingechaur yielded a bronze dagger and four decorated flutes made of antler. In grave 77 at Mingechaur, dated 11th to 9th

centuries B.C., two bone bridoons were found which, according to A. N. Melentiev (*SA* 1968 (1), pp. 226–229) attest to connections between the stock-breeders of eastern Transcaucasia and those of the steppe country north of the Caucasus at the turn of the second and first millennia B.C. They also point to the use of chariots for warfare at that time. Of interest also is a grave of the slab-cist grave cemetery at Khachbulog in which, according to G. P. Kesamly (*SA* 1966 (3), pp. 221–227) a decorated bronze belt was found. Finally, Dj. A. Khalikov (*SA* 1960 (4), pp. 68–75) reports on the results of the excavation of a settlement near Kazakh, situated on a hill called Sary Tepe. It was set up by the beginning of the first millennium B.C. and its pottery calls to mind that of Karmir Blur, the Urartian fortress in Armenia. I. G. Narimanov (*SA* 1964 (4), pp. 162–164) reports that on the same hill foundations have been uncovered of a larger building with stone columns. The building was of the 5th to 4th century B.C.; it implies the close connections of Azerbaijan with ancient Iran at that time.

Several publications are devoted to the kingdom of Urartu and various topics connected with it, and to the excavation of Urartian fortresses, Karmir Blur in particular. Here belongs the work *Vanskoe Tsarstvo* (*Urartu*) (*The Kingdom of Van* (*Urartu*)), Moscow 1959, 284 pages, 88 illustrations, 56 plates) by B. B. Piotrovskii. It deals with the Urartian written history, archaeology, economy, handicrafts, architecture, religion, relations with other peoples including the Scythians, etc. There is also an Italian translation of the work *Il Regno di Van—Urartu* (Rome 1966, 397 pages, 88 figures and 56 plates, published in the series Incunabula Graeca, vol. XII) and its shortened version in English *Urartu. The Kingdom of Van and its Art* (London 1967, Evelyn, Adams and Mackay, 111 pages, 30 plates). Another fine and well-written work by B. B. Piotrovskii, at present the Director of the Hermitage Museum in Leningrad, is *Iskusstvo Urartu—VIII—VI v.v.do. n.e.* (*Art of Urartu, 8th to 6th centuries B.C.*, Leningrad 1962, 123 pages, 81 figures, 36 plates). It gives a brief history of Urartu and its archaeological remains and discusses various aspects of Urartian art, its origins and connections. The book *Zemledelie i Skotovodstvo Urartu* (*Agriculture and Animal Breeding of Urartu*, Erevan 1964, 226 pages, 45 figures including two folded maps) by N. V. Arutyunian, contains statistical data relating to cattle-raising and agriculture in Urartu and its neighbouring country of Biainili.

Preliminary reports on the excavation of the Karmir Blur-Teishebaini fortress and descriptions of remarkable finds from that site were published by B. B. Piotrovskii (*SA* 1959 (2), pp. 169–186; *KSIAM* 100, 1965, pp. 72–78), A. A. Martirosyan (*SA* 1958 (1), pp. 163–170), and V. S. Sorokin (*SA* 1958 (2), pp. 149–163), who describes the pre-Urartian settlement, remains of which were found under the layer of the Urartian fortress; they were of the 12th to 8th centuries B.C. The settlement was probably destroyed by the conquering

Urartians. P. M. Dzanpoladyan (*SA* 1964 (1), pp. 307-312) publishes an Egyptian faience figurine, a glass bead and an alabaster phial, found in Karmir-Blur; they were all imported from central or western Asia in the 8th or 7th centuries B.C.

Another Urartian fortress and important administrative centre has been investigated at Erebuni near Erevan. Preliminary reports on its excavation have been published by I. M. Loseva (*SA* 1958 (2), pp. 179–195) and by K. L. Ofanesyan (*SA* 1960 (3), pp. 289–296). A similar report on the investigation of another Urartian fortress, Argishtikhinili, on the left bank of the Araxes, constructed in 776 B.C. and abandoned probably in 595 B.C. has been published by A. A. Martirosyan (*SA* 1967 (4), pp. 220–236) and K. Kafadaryan (*SA* 1967 (4), pp. 237–247) discusses Urartian architecture as represented by stone constructions uncovered in this fortress.

A special study by M. N. Pogrebova (*SA* 1967 (2), pp. 137–145) is devoted to finds of Urartian swords in Transcaucasia and to the discussion of the significance of their diffusion. T. N. Chubinishvili (*NSA*, pp. 198–201) describes the recently-found, or acquired, objects of Urartian origin in southern Georgia; they imply that the local population must have been in close contact with the countries of ancient Oriental civilisation during the 8th to 6th centuries B.C.

Amulets connected with the worship of the sun, found in Soviet Armenia, have been dealt with by S. A. Esayan (*SA* 1968 (2), pp. 255–266); the author emphasizes that the worship was very widespread in Armenia until about the 6th to 5th centuries B.C.

A. A. Martirosyan (*SA* 1964 (3), pp. 21–36) discusses the age of Armenian archaeological remains; he established a chronological scheme in which the development from *c.* 2500 B.C. to the 6th century B.C. has been divided into eleven periods, the Late Bronze Age being subdivided into three stages. During the last of the latter, in the 10th century B.C., iron objects began to appear in Transcaucasia but it is only in the 7th to 6th centuries B.C., the period of the Urartian Kingdom, that iron has been widely used there. A useful paperback, or rather two such, may be mentioned. They are the *Catalogues of the Historical Museum of the Town Erevan in Soviet Armenia* by S. A. Esayan. The first issue was published in 1964, the second in 1967, both in Armenian with summaries in Russian and English. The first contains 76 pages and 18 plates, the other 118 pages and 37 plates. Remains are numbered and the descriptions are arranged in chronological order, from the Aeneolithic to the Middle Ages. The same author also published (*SA* 1965 (3), pp. 229–233) a barrow grave of the 6th to 5th centuries B.C. investigated at Gözla in Armenia; its pottery was similar to that found in Karmir-Blur. Finally, S. A. Esayan jointly with A. N. Shingiyan (*SA* 1962 (3), pp. 198–208) discuss a slab-cist grave found at Zangezure and its specific grave goods, and also bronze objects of Urartian type from Sznak, both in Armenia.

Byelorussia and the North-West

A few books of a general character relating to the area have been published recently. One of these is *Arkheologiya Belorussii* (*Archaeology of Byelorussia*, Minsk 1965, 225 pages, in Byelorussian) by E. M. Zagorulskii. The book is not available in London; its positive review, by O. N. Melnikovskaya and L. V. Alekseev, appeared in *SA* 1968 (3), pp. 291–296. Another book is *Latviya v Epokhu Pozdney Bronzy i Rannego Zheleza* (*Latvia in the Late Bronze Age and Early Iron Age*, Riga 1967, 167 pages, 42 plates) by Ya. Ya. Graudonis. It deals with cultures of Latvia and their transformation during the Bronze Age, in the second half of the second and the first half of the first millennia B.C. and during the Early Iron Age, up to the end of the first millennium A.D. It contains descriptions of settlements and burials investigated, discussions on the archaeological material, on the economy and social organisation of the population at the periods under review, and on the ethnic problems. The third book is *Drevnyaya Istoriya Severo-Zapada Evropeyskoy Chasty SSR* (*Ancient History of the north-west of the European part of the U.S.S.R.*, *MIA* 87, 1961, with summaries in English and German) by N. N. Gurina. The theme of the book is prehistoric remains of the region of Leningrad and Karelia from the Mesolithic to the 3rd century A.D. Special maps show the diffusion of sites in different periods; sites of Karelian Early Metal period are mapped in fig. 212. Finds of the Early Metal period have been discussed in pp. 81–112 and those of the Early Iron Age in pp. 113–119. The work has been reviewed by V. P. Tretiakov and G. P. Grigoriev (*SA* 1968 (4), pp. 271–275), who do not agree with some of the statements relating to the attribution of finds and also partly disagree with the chronology of a number of cultures distinguished by the author.

Another important publication is the book *Istoriya, Arkheologiya, Etnografiya, Karelii* (*History, Archaeology, Ethnography of Karelia*, Petrozavodsk 1967, 268 pages). This is a bibliography of Soviet literature on the subject for the years 1917–1965. Anthropological publications (pp. 221 f.) contain a few items relating to the results of the palaeoanthropological studies of the country.

Finally, the article by F. M. Zavernyaev (*SA* 1964 (1), pp. 146–157) should be mentioned. It deals with the investigation of an earthwork and of cemeteries of the Late Bronze Age in the basin of the upper Desna, in the region of Briansk. All the remains, of types already known in Russia proper, represent an eastern branch of the Trzciniec-Komarów culture (with an admixture of local elements) characteristic of south-east Byelorussia and north Ukraine.

Central Russia and the North

The book *Etnicheskaya Istoriya Volgo-Okskogo Mezhdurechya* (*Ethnic History of the country between the Volga and the Oka*, *MIA* 94, 1961, 268 pages) by E. I. Goriunova, deals with topics relating to the cultures of the central part of Russia proper of the second millennium B.C. (Fatianovo, Abashevo,

Srubnaya) and also with those of the first half of the first millennium B.C. (Galich). The development in the country on the upper Volga, in the region of Kostroma, has been discussed by N. N. Gurina in her work 'Pamyatniki Epokhi Bronzy i Rannogo Zheleza v Kostromskom Povolzhye' ('Remains of the Bronze Age and the Early Iron Age in the country on the Volga around Kostroma', *MIA* 110, 1963, pp. 85–203). It also contains full reports on the excavation of a number of sites in that region. In the same volume of *MIA* 110 (pp. 239–269) a report has been published by A. Kh. Khalikov and E. A. Khalikova on the investigation of a stratified settlement at Vasilsurskoe on the Sura, built as an earthwork in the second millennium, which survived to the first millennium B.C.

O. V. Ovsyannikov and G. V. Grigorieva (*KSIAM* 102, 1964, pp. 22 f.) describe recently-found remains of an iron foundry at Olskii Mys on Lake Lacha near Kargopol. It belonged to the Late Kargopol culture which the authors date as of the first half of the first millennium B.C. The date seems to have been estimated as too early.

The paperback *Drevnii Sindor* (*Ancient Sindor*, Moscow 1967, 218 pages, 25 figures including a series of maps, 34 plates) by G. M. Gurov is, according to the sub-title, a short history of the north-east of Russia in Europe during the period from the seventh millennium B.C. to the first millennium A.D. Investigations of many sites have been described and pottery and implements discussed. Remains of the Bronze Age are considered to have been mainly of the second millennium, although a large portion were evidently of the early first millennium (pp. 112–121).

The country on the middle Volga

Results of the investigation of the late Srubnaya settlement at Komarovka on the river Usa (Lake Moechnoe) near Kuibyshev, have been presented by A. E. Alikova (*MIA* 61, 1958, pp. 157–180), according to whom the settlement was in existence from the 10th to 8th centuries B.C. Bone cheek-pieces of a late type were found there. The same author describes a number of other settlements and barrow grave cemeteries of the Late Bronze Age investigated in the same region (*MIA* 80, 1960, pp. 96–119); the latest of these were of mid-7th century B.C. A preliminary report on the excavation of a cemetery at Novo-Mordovo near Kuibyshev has been published by A. Kh. Khalikov (*SA* 1963 (3), pp. 180–190). The cemetery, the burial place of the local chieftains, was in use from the end of the 8th to the beginning of the 6th centuries B.C. Stone stelae with engraved daggers and battle-axes were found in graves encircled by stones. The graves represent a variant of the late Srubnaya culture; Siberian connections are well reflected on the weapons found there.

Remains of the Late Bronze Age of the country further to the north, of the region of Kazan, the middle Volga and the lower Kama, have been dealt

with by A. V. Zbrueva (*MIA* 80, 1960, pp. 10–95); special attention has been devoted to the Lugovskaya site and other sites of the pre-Ananino type in the region, and to barrow graves of the late second and early first millennia B.C. The article by A. Kh. Khalikov (*SA* 1968 (2), pp. 23–40) is devoted to the Kazan culture, the development of which took place mainly during the second millennium B.C.; a chronological graph is added there. A special book by several authors, *Zheleznii Vek Mariyskogo Kraya* (*The Iron Age of the Mariiskii Country*, Yoshkar-Ola, 1962, 266 pages), has been devoted to the Early Iron Age of the Mariiskaya SSR, the country west of Kazan, north of the Volga. The book was not available in London but its review appeared in *SA* 1967 (2), pp. 260 ff. V. S. Patrushev and A. Kh. Khalikov (*AO* 1966, pp. 94 ff.) publish a brief account of the results of the investigation of a large cemetery (400 burials) at Akhmylovo, north-west of Kazan, of 8th to 6th century date. It exhibits a very elaborate burial ritual with special mourning houses, or houses of the dead, and concentrations (evidently offerings) of horse skulls, etc.

G. A. Fedorov-Davydov and A. V. Tsirkin (*SA* 1968 (4), pp. 174 ff.) describe the results of the investigation of an important stratified settlement at Ziravkino in the Mordovskaya SSR, west of the middle Volga, north of Penza. It was inhabited from the late-second millennium B.C. to mid-first millennium A.D. The site lay on the border between central Russia and the middle Volga-Urals cultural provinces. Its inhabitants maintained connections with the peoples of the two neighbouring provinces.

N. V. Trubnikova (*KSIIMK* 75, 1959, pp. 163–168) deliberates on the origin of the Gorodetskaya culture, that extended between the Oka-Volga and the Tsma; according to the author, it was formed in the first half of the first millennium B.C.; its constituents were the Srubnaya culture and some local tribes. The culture has been dealt with in a special volume, *Gorodetskaya Kultura* (*The Gorodetskaya Culture*, SVOD D-1-14, Moscow 1965) by A. P. Smirnov and N. W. Trubnikova. The formation of the Ananino culture further north, on the middle Volga and lower Kama, was discussed by V. P. Shilov (*AF*, pp. 120–126), according to whom it was formed by the turn of the second and first millennia B.C.; this date seems to have been estimated a few centuries too early. Its formation was the outcome of the amalgamation of the local population of Neolithic ancestry and of Europoid racial type with newcomers from Siberia of Mongoloid racial type.

The Urals and the country around

Conditions in the south Urals country during the second and early first millennia B.C. have been dealt with by K. V. Salnikov in the book *Ocherki Drevney Istorii Iuzhnogo Urala* (*Essays on the ancient history of the south Urals*, Moscow 1967, 408 pages). The same author (*SA* 1968 (1), pp. 3–9) briefly discusses topics connected with the cultures of the Bronze Age in the south

Urals from the mid-second millennium to the 8th century B.C.; among these is the problem of the origin of the Abashevo, Srubnaya and Andronovo cultures and the formation of local cultures of the early first millennium B.C., called the Chebarkulskaya and Kurmantau cultures. In another article the same author (*NSA*, pp. 160–164) discusses the development and chronology of some types of local socketed axes (celts); a map attached to the article shows the diffusion of the different types of these in the south Urals and the neighbouring regions. The earliest celts of the Urals were of the 15th to 12th centuries B.C.; some of the late types survived to the second half of the first millennium B.C.

A brief report on the excavation of the settlement of the Early Iron Age, the early first millennium B.C., called Chebarkul IV, near Cheliabinsk, has been published by D. Ia. Krizhevskaya (*KSIAM* 102, 1964, pp. 114–118). The author also discusses relations of the inhabitants of the settlement with other countries, especially with the south Urals; the inhabitants might have been originally one of the forest zone tribes of the middle Urals.

A large contribution by A. P. Smirnov, 'Zheleznyi vek Bashkirii' ('The Iron Age of Bashkiria', *MIA* 58, 1957, pp. 5–113) is devoted to the study of the development in the country west of the south Ural mountains during the Late Bronze Age and the Early Iron Age, the final second and early first millennia B.C. The reciprocal connections and differences between the cultures distinguished in the country during that time, and their relations with cultures of other countries, have been discussed by the author. Results of the investigation of the site called Kasynovskaya at Mikhaylovka, district of Gafurino in Bashkiria, have been published by A. V. Zbrueva (*Bashkirsii Arkheologicheskii Sbornik*, Ufa 1959, pp. 47–57). This was the latest Bronze Age site known so far in that country; it was of the pre-Ananino period, of the early first millennium B.C.

Results of the excavation of a settlement of the early first millennium B.C. at Vasyukovskaya in the country on the river Kama north of Perm have been given in a short report by V. P. Denisov and two other authors (*AO* 1966, p. 101).

West Siberian forest zone

Investigations have been conducted at several points in this huge territory. In the west, excavations at the site Suzgun II on the Irtysh near the junction with the river Tobol, have been reported by V. I. Moshinskaya (*MIA* 58, 1957, pp. 114–135). Sherds of over 700 vessels, moulds, carved bones, etc., were found. The pottery has some parallels with that of the Andronovo culture, but also with the pottery of site Bor II on the Kama, west of the Urals. V. F. Gening (*AO* 1966, pp. 102 ff.) gives an account of investigations of several sites along the rivers Tobol and Ishim, and especially of the earthwork of the 7th to 6th centuries B.C. at Likhachevo near Tiumen, one of the earliest earthworks in

west Siberia. The results of investigations in the northern part of west Siberia (Yamal Peninsula) have been briefly summarized by A. P. Khlobistyn (*AO* 1967, pp. 147 ff.); several sites were of the first millennium B.C., especially near Yar-Sale.

The results of the excavation of a barrow grave cemetery and of a settlement at Elovka, district of Kozhevnikovo, near Tomsk, have been briefly mentioned by V. I. Matiushchenko and two other authors (*AO* 1966, pp. 153–155) and described by V. I. Matiushchenko and L. G. Igolnikova (*SAS* 2, 1966, pp. 183–195). Many hearths built of stone and traces of some kind of huts or dwellings on the surface of the ground have been noticed. The site yielded a large amount of pottery, bone objects, moulds for casting bronze weapons and tools, etc. The authors point out the similarity of the pottery to that of the Karasuk culture and of other Siberian cultures, and conclude that the site, and a few other similar sites in the area, represent a distinct culture of the second stage of the local Bronze Age; the change from the Tomsk culture, characteristic of the first stage, to the new one was due to the influx in the country of some new ethnic elements from south Siberia. The area of the new culture has been determined by the authors.

M. F. Kosarev (*KSIAM* 101, 1964, pp. 44–48) discusses the decoration of pottery of the first millennium B.C. of the country of the valley of the Ob in the region of Narym, *c.* 400 km. north-west of Tomsk. On a graph (p. 46) is set out the development of the decorative motifs of the pottery of cultures from a wide territory, extending over the steppe, the forest-steppe and forest zones of west Siberia from the early second millennium B.C. to the Iron Age. The same author (*KSIAM* 97, 1964, pp. 82–87) deliberates on the date of the Desyatovskoe settlement on the lower Chulym (oblast of Tomsk) and suggests its date is the early first millennium B.C. The development in the forest zone of the area on the river Ob during the Late Bronze Age until the period of the Sarmatian culture is the theme of another article by this author (*SA* 1964 (2), pp. 211 ff.), based on his own excavations and field-work. Farther south, at Tukay, a hoard of bronze objects of Karasuk type of the 10th to 8th centuries has been found and has been described by N. L. Chlenova (*KSIAM* 114, 1968, pp. 84–93) and T. N. Troitskaya (*KSIAM* 114, 1968, pp. 99–104) reports on the investigation of a settlement of the 7th to 6th centuries at Zavyalovo on the Karakan, oblast of Novosibirsk.

V. N. Poltoratskaya (*ASE* 3, 1961, pp. 74–88) describes the cemetery of Berezovka I near Biisk on the upper Ob. It belonged to the Bolsherechenskaya culture, the earliest stage of which has been considered to be 'pre-Scythian', prior to the 7th to 6th centuries B.C. Chapter XII (pp. 147–151) of *Contributions to the Physical Anthropology of the Soviet Union* (Peabody Museum, Cambridge, Mass., 1960) contains a study by V. P. Alekseev on the palaeoanthropology of forest tribes on the northern Altai. It deals with the cranial material from

Karasuk graves of the 10th to 8th centuries B.C. from Blizhnie Elbany on the upper Ob, and of the subsequent stage (7th century B.C. to 1st century A.D.) of the Bolsherechenskaya culture, and also the material from the Berezovka cemetery mentioned above. The author points to the relative antiquity of the Mongoloid type in the forest and forest-steppe zones of the Altai Mountains. On the other hand, the Mongoloid type was non-existent in the steppe of the Altai region until the end of the Karasuk period; the physical type of the inhabitants of the Blizhnie Elbany settlement slightly changed to the Mongoloid during the Bolsherechenskaya and later periods.

Kazakhstan steppe country

During the early first millennium B.C. the Andronovo people still lived in the country; the relevant literature has been quoted in my second report (*Bulletin* 7, 1968, pp. 75–78). Changes that occurred in different parts of the country at the transition from the Middle to the Late Bronze Age (usually put in the 10th or 9th centuries B.C.) has been discussed by several authors; they also describe the remains of the Late Bronze Age, that lasted until the 8th (rather to the end of the 7th) century B.C. and point to their characteristic features.

The Late Bronze Age of northern Kazakhstan has been dealt with by A. M. Orazbaev (*TIIAEK 5*, 1958, pp. 270–282). Typical of this period were remains of the Zamarayevskaya type, which some scholars look upon as forming the latest stage of the Andronovo culture, but the author considers them to form a distinct culture dated to the 9th to 8th centuries B.C. The same opinion is also held by M. N. Komarova (*ASE* 5, 1962, pp. 60 ff., likewise quoted in my report, *Bulletin* 7, p. 75); she dates it to the 8th to 7th centuries B.C., the transitional period to the Karasuk culture. Several cemeteries, settlements and other finds of the Late Bronze Age in this area have been described by K. Akishev (*TIIAEK* 7, 1959, pp. 3–31). K. A. Akishev (*AO* 1966, pp. 291) also reports on excavation of a settlement of the early first millennium B.C. (the Late Bronze Age) at Oktyabrskoe on the Chaglinka in northern Kazakhstan and of a barrow grave cemetery of the same period in the same region.

Late Bronze Age remains of central Kazakhstan have been dealt with by A. M. Orazbaev (*TIIAEK* 7, 1959, pp. 59–74); they were of the Dyndybay type mainly of the 10th to 8th centuries B.C.

The Bronze Age of Eastern Kazakhstan is the theme of a large article by A. G. Maksimova (*TIIAEK* 7, 1959, pp. 87–139) in which Late Bronze Age remains have also been discussed (pp. 104–116 and 138). Changes that occurred there after the 8th century B.C. have been deliberated on by S. S. Chernikov in his work *Vostochnyi Kazakhstan v Epokhu Bronzy* (*Kazakhstan in the Bronze Age*, *MIA* 88, 1962, pp. 98 ff.). The same author also describes a number of settlements of the 8th and 7th centuries B.C. investigated in eastern Kazakhstan (*KSIIMK* 73, 1959, pp. 99–106).

Finally, the article by K. Bayrakov (*SA* 1964 (2), pp. 244–251) should be mentioned. It discusses the archaeological literature published in the editions of the Academy of the Kazakhstan SSR during the period 1946–1962.

Soviet Central Asia

Several reports on excavations relate to the countries of Soviet Central Asia. A work of a general character, by several authors, is *Tsentralnaya Aziya v Epokhu Kamnya i Bronzy* (*Central Asia during the Stone and Bronze Ages*, editor V. M. Masson, Moscow-Leningrad 1966, 288 pages, 10 plates, 54 figures). The development of the cultures and the general conditions during the whole prehistoric past, from the Palaeolithic to the Achaemenian conquest in mid-first millennium B.C. have been dealt with for the whole area, including the steppe country of Semirechie east of Lake Balkhash. Pp. 174–159 are devoted to the first millennium B.C. A large bibliography, including works published outside the U.S.S.R. in western languages, and a chronological table have been added. Other works of a general character quoted in my second report (*Bulletin* 7, p. 80) also cover the period under review. The work *Istoriya, Arkheologiya i Etnografiya Sredney Azii* (*History, Archaeology and Ethnography of Central Asia*, Moscow 1968, 368 pages), the *Festschrift* of S. P. Tolstov, containing 44 articles by 48 authors, includes no articles concerned with the first half of the first millennium B.C.

A graph published by M. A. Itina (*Trudy Khorezmskoy Arkheologo-Etnograficheskoy Ekspeditsii* IV, 1959, p. 62) shows examples of Khorasmian pottery arranged in a chronological sequence. During the first half of the first millennium B.C. first the Suyarganskaya culture had developed (11th to 9th centuries B.C.), followed by the Amirabad culture (9th to 8th centuries B.C.). Next was the 'archaic period' of Khorasmia (7th to 6th centuries B.C.), pottery of which was dealt with by M. G. Vorobleva in the same volume of *Trudy* (pp. 66–84). The latter author also reported on the excavation of a settlement of the first half of the first millennium B.C. at Dingildzhe (*MKE* 1, 1959, pp. 70–80).

Chapter 2 (pp. 36–47) of the report on the work of the 'Chorasmian Expedition' in 1958–61, by S. P. Tolstov, T. A. Zhdanko and M. A. Itina (*MKE* 6, 1963) contains the account of the excavation of the important cemetery of Tagisken near Kzyl-Orda in the ancient delta of Syr-Daria, of the first half of the first millennium B.C. (till the 8th century B.C.). The two formative elements of the Tagisken culture were the ancient higher southern civilization and the Bronze Age traditions of the Andronovo culture of Central Kazakhstan. In the same volume (*MKE* 6, 1963, pp. 107–129) M. I. Itina presents the results of her excavation of a large settlement of the 9th to 8th centuries B.C. at Iarke-Parsan 2, in the Turtkul district (near Khiva); and V. N. Yagodin (*MKE* 6, 1963, pp. 130–140) reports on the excavation of a settlement of the Amirabad

culture called Kabat 2 approximately in the same region, which was in existence from the 9th to early 7th century B.C. The author also comments on the importance of the results obtained from the study of the origin of the culture. M. A. Saburiva and V. N. Yagodin (*SA* 1964 (1), pp. 304–307) describe a mould for casting bronze horse-bits found in ancient Chorasmia, dated as the 8th to 6th centuries B.C. The earliest bits in that area were found in the remains of the Amirabad culture in the 11th century B.C.

V. M. Masson (*SA* 1958 (2), pp. 49–65) discusses problems relating to ancient Bactria and concludes that the archaeological material supports the ancient traditions of the existence of an independent Bactrian state at the time prior to the Achaemenian conquest. The same theme has been dealt with by the same author in his contribution 'Drevnezemledelcheskaya Kultura Margiany', (*Ancient Agricultural Culture of Margiana*, *MIA* 73, 1959, pp. 93–121), devoted to the Late Bronze and Early Iron Ages (1000–500 B.C.) of south Turkmenia. The reciprocal relations between the different cultures of that area have been discussed, and Table 4 (p. 91) shows a chronological graph of the cultures involved. The worship of a female goddess by the Anau tribes has been the theme of a special article by V. M. Masson (*KSIIMK* 73, 1959, pp. 14–20), which contains the description of figurines and figures painted on pottery found in the area in remains dated from the 3rd to the middle of the 1st millennia B.C. The history of pottery in south Turkmenia has been briefly discussed by L. M. Rutkovskaya (*SA* 1964 (2), pp. 221–227).

The excavation of Altyn-Tepe (chiefly Namarga IV period, partly Namazga V) in south Turkmenia has been reported by A. F. Ganyalin (*SA* 1967 (4), pp. 207–219), and again by V. M. Masson (*AO* 1966, pp. 329–333). The latter deals mainly with the upper layers of the settlement, of Namazga V type. Of special interest are zoomorphic seals (fig. p. 331), the style of which may be looked upon as a predecessor of the Scytho-Sarmatian animal style. The author thinks that south Turkestan was one of the chief areas in which the Scythian animal style was formed, based on ancient, Bronze Age, local traditions.

The volume *Drevnosti Kayrak-Kumov* (Trudy Instituta Istorii Akad, Nauk. Tadzhikskoy SSR XXXIII, Dushanbe 1962) contains the work 'Pamyatniki Epokhi Bronzy i Rannego Zheleza Kayrak-Kumov', ('Remains of the Bronze and Early Iron Ages of Kairak-Kumy', pp. 89–300, tables 35–117, 41 figures), in which the remains of the early first millennium B.C. of south Tadzhikstan have been described, and the tribal movements of the period discussed. The work *Pamyatniki Epokhi Bronzy v Iuzhnom Tadzhikstane* (*Remains of the Bronze Age in south Tadzhikstan*, *MIA* 145, Leningrad, 1968, 184 pages) by A. M. Mandelshtam, reports on the excavation of two cemeteries, Tulkharskii and Aruktauskii, in ancient Bactria. They continued to be used in the early first millennium B.C. The same volume also contains a contribution by I. V. Bogdanova-Berezovskaya (pp. 163–168) giving the results of the chemical

MAP II

1 Namazga Tepe
2 Altyn Tepe
3 Iarke-Parsan and Kabat
4 Karadarinskii Oasis
5 Samarkand
6 Tutkaul
7 Dakhan
8 Andizhan
9 Dalverzin
10 Oktyabrskoe
11 Chebarkul
12 Likhachevo
13 Suzgun
14 Yar-Sale
15 Narym
16 Tukay
17 Desyatovskoe
18 Elovka
19 Zavyalovo
20 Blizhnie Elbany
21 Predgornoe
22 Berezovka
23 Malye Kopeny
24 Bolshaya Boyarskaya
25 Kyurgenner
26 Zhur
27 Ust-Uda
28 Sites on the Podkamennaya Tunguska
29 Sites on the Vilyuy
30 Buokalaakh
31 Ust-Belaya
32 Ulan-Khada
33 Aginskoe
34 Settlements of ancient Chorasmia (Dingildzhe, Tagisken)
35 Polyakovo
36 Poltso-Kukelevo
37 Settlements in the Bay of Peter the Great
38 Settlements in the Pkhusun Bay
39 Voznesenovka
40 Susunskaya
41 Starodubskoe

analysis of bronze objects found in the two cemeteries mentioned above; and another contribution, by T. P. Kiyashkina (pp. 168–182) brings the results of the anthropological study of the cranial material from these. The results of the excavation of a stratified settlement at Tutkaul have been published by B. A. Litvinskii (*AO* 1966, pp. 313 ff.); the author also briefly discusses a few other settlements of the Bronze Age, the late second and early first millennia B.C., in the steppe part of the country.

The work *Drevnezemledelcheskaya Kultura Fergany* (*Ancient Agricultural Culture of Fergana* (*Northern Tadzhikstan*), *MIA* 188, 1962) by Iu. A. Zadneprovskii, mentioned in my second report (*Bulletin* 7, p. 82) deals also with the remains of the first millennium B.C. It is here that the final stage of the development of the Chustskoe culture (10th to 7th centuries B.C.) belongs. The date of one of the settlements has been determined by Carbon 14 as 760±120 B.C. (RUL-127). The book has been supplemented by three articles: by an anthropological analysis of the cranial material from Bronze Age cemeteries by V. V. Ginsburg (pp. 201–218); chemical analysis of metal finds by I. V. Bogdanova-Berezovskaya (pp. 219–230); and by an analysis of imprints of tissue found on pottery of three settlements investigated by G. F. Korobkov (pp. 231–234). A large list of the literature on the subject has been added at the end of the volume (pp. 235–248).

A brief review of the culture of Fergana in the first half of the first millennium B.C. and an analysis of the sepulchral pottery of that period, has been given by N. G. Gorbunova (*SA* 1962 (4), pp. 37–48), who distinguishes two different cultural groups in Fergana at that time, a western and an eastern one. The chronology of agricultural cultures of Fergana from the 8th century B.C. to the 8th century A.D. has been briefly discussed by B. A. Latynin (*AF*, pp. 111–119), and stages in their development shown in a graph (p. 119). A similar chronological scheme of the development in Fergana from *c.* 1500 B.C. to the 8th century B.C., has been published by the same author (p. 128) in a larger article (*ASE* 3, 1961, pp. 109–170). The article also comments on the results of investigation of the ancient irrigation network of ancient Fergana and the description of several settlements investigated.

Excavation of the stratified settlement at Dalverzin in the Fergana valley have been briefly reported by Iu. A. Zadneprovskii (*KSIAM* 86, 1961, pp. 43–54; *AO* 1967, pp. 308 f.). The settlement had three occupation horizons. The lower one shows some similarity to Namarga VI remains of the second half of the second millennium. The upper one was of the Late Bronze Age. Carbon 14 determination (*Radiocarbon* 7, 1965, p. 227) of the lower layer is 1100 B.C. (RUL-323) and of the upper layer 770 B.C. (RUL-127). B. A. Litvinskii (*KSIIMK* 80, 1960, pp. 47–52) reports on excavation of a flat cemetery of the early first millennium B.C. at Dakhan near Asht, in the northern part of the Tadzhik SSR, west of Fergana, and points to the similarity of the stone construction of its

tombs to those of the Andronovo culture in Kazakhstan and Siberia, and discusses its implications. A preliminary report on the excavation of the earthwork at Andizhan in the Uzbek part of the Fergana valley, has been published by T. G. Oboldueva (*KSIAM* 91, 1962, pp. 38–47); this was the only well-preserved earthwork of mid-first millennium B.C. in Fergana. The material revealed connections of the inhabitants with the people of the Chudskaya culture represented by the upper layer of Dalversin settlement.

Stages in the development of the Karadarinskii oasis in south Kirgistan have been discussed by Iu. A. Zadneprovskii (*KSIAM* 98, 1964, pp. 18–22). About 100 'tepe' and earthworks have been recorded there; the earliest ones were of the Late Bronze Age, including that of Chumbay on the Kara-Daria. The settlements were set up at the turn of the second and first millennia B.C. and their inhabitants were engaged in agricultureal activities. Carbon 14 determination of the occupation horizon of the earthwork Shurabashat I in the Kirgiz country, investigated by Iu. A. Zadneprovskii, is 770 B.C. (RUL-127), the Bronze Age of the country.

South and East Siberia

The Tagarskaya culture, characteristic of the late second millennium was the theme of several articles by various authors mentioned in my second report (*Bulletin* 7, pp. 75, 79). The culture survived to the early first millennium. Investigations of a few cemeteries of the late period of the culture, especially in Khakassia, have been briefly reported in *AO* 1966 by M. P. Gryaznov and M. N. Komarova (p. 137; at Kyurgenner); A. P. Zyablin (pp. 138 f.; at Malye Kopeny 3); and by G. A. Maksimenkov (pp. 139 ff.). M. P. Gryaznov (*KSIAM* 100, p. 1968, pp. 62–71) gives account of investigations at a number of sites in the central part of Siberia in the region of Krasnoyarsk. Among these was the late Karasuk settlement (10th to 8th centuries B.C.) at Kamennyi Log I, and two cemeteries of the 7th to 6th centuries B.C. at Malye Kopeny and Grishkin Log I near Bateni.

N. L. Chlenova (*SAS* 2, 1966, pp. 212–228) reports on the excavation of the barrow grave cemetery at Zhur, 156 km. south of Achinsk in the north of the Minusinsk valley, which was in use in the second millennium up to the 7th to 6th centuries B.C. She then discussed the reciprocal relations during the Bronze Age between the tribes of the forest zone and those of the steppe zone in the area of the Minusinsk valley on the Yenissey. Two bronze celts of east Siberian type of the 8th century B.C. found in burials on the Yenissey were dealt with by M. P. Zavitukhina (*SA* 1966 (3), pp. 228–230), and M. D. Khlobistyna (*SA* 1967 (1), pp. 246–250) discusses pendants of a special type common in the valley of the Yenissey, often found in female burials of the Karasuk culture; they are strikingly similar to the bone pendants of the Boian and early Tripolyan cultures.

G. I. Andreev and Iu. M. Fomin (*KSIAM* 114, 1968, pp. 46–49) report on further investigation at a settlement on the junction of the Podkamennaya Tunguska with the Yenissey, dated from the late second to the early first millennia B.C.

A paperback *Drevnie Kultury Verkhnego Vilyuya* (*Ancient Cultures of the Upper Vilyuy*, Moscow 1968, 172 pages, 53 figures, including plans) by S. A. Fedoseeva, brings a concise description of main archaeological sites in the valley of the Vilyuy, a 2450 km. long tributary of the lower Lena, preceded by a brief geographic setting and history of investigations of the basin of the river. Three main periods have been distinguished, the Neolithic (fourth to second millennia B.C.), the Bronze Age (the end of the second to mid-first millennium B.C.), and the Iron Age (to mid-first millennium A.D.) The population of the area was closely related to that of the Lake Baikal area, roughly 1000 km. farther south. No changes in the population are reflected in the archaeological material during the whole prehistoric age.

P. I. Glushinskii and L. P. Khlobistyn (*SAS* 2, 1966, pp. 151–159) give account of the investigation of a site called Buokalaakh, situated about 1200 km. north of the Vilyuy valley, close to the estuary of the Olenek in the extreme north of central Siberia. Its implements made of siliceous slate and pottery have close parallels in the sites on the Lena, typical of the Siberian Bronze Age, at the turn of the second and first millennia B.C.

The country around Lake Baikal

A number of settlements, some of them stratified, and burials, including those of the cemetery at Ust-Uda, were investigated by A. P. Okladnikov and his associates (*KSIIMK* 76, 1959, pp. 33–41). They dated from the fourth millennium to the late second millennium, but the upper layer of some settlements was of the Bronze Age and the Early Iron Age (the first millennium B.C. and after). A. P. Khlobistyn (*KSIAM* 97, 1964, pp. 25–32), as mentioned in my former report (*Bulletin* 7, p. 79) discusses the chronology of the stratified settlement at Ulan-Khada on Lake Baikal; its upper layer I was of the period 1200–800 B.C. Another stratified settlement, at Ust-Belaya, north-west of Irkutsk, was investigated by G. M. Zaytseva (*AO* 1966, pp. 168 f.); its upper layer was of the Late Bronze Age. According to M. P. Aksenov (*AO* 1966, p. 169) the upper layer of the stratified site at Makarovo on the upper Lena was also of the Late Bronze Age and the Early Iron Age.

O. P. Okladnikov (*SA* 1959 (3), pp. 114 ff.) discusses a specific type of vessel, a kind of tripod consisting of three interconnected sack-shaped vessels, found at Aginskoe, east of Lake Baikal. The vessels were of a type widespread within a large territory extending from Lake Baikal eastwards to the river Amur. They were found in many graves of the culture of 'the burials under slabs' (10th to 5th centuries B.C.), as shown on map (fig. 7). They developed under Chinese

influence and map 8 shows the diffusion of Chinese tripods. Iu. S. Grishin describes 'graves under slabs' in the valley of the Onon, and discusses their chronology (*SA* 1968 (1), pp. 177–184). In another article (*SA* 1968 (3), pp. 180–182), the same author publishes a bronze sword with a zoomorphic top to the haft, found in the steppe east of Lake Baikal. The sword is of a type characteristic of the forest zone of Siberia, but the analysis of its metal implies that it must have been a local product of the period between the 13th and the 8th centuries B.C. The same author (*KSIAM* 114, 1968, pp. 10–12) points out that during the Karasuk period (13th to 8th centuries B.C.), tin deposits were exploited in the country east of the Baikal Sea.

Soviet Far East

A number of articles mentioned in my second report (*Bulletin* 7, pp. 82 f.) refer to the circumstances in this area during the first millennium B.C. Among important publications concerned with the period is *Materialy po Istorii Sibiri*, vol. I (Novosibirsk 1964) devoted to the archaeology and ethnography of the Soviet Far East. A. P. Okladnikov gives there (pp. 9–48) a brief history of archaeological investigations and surveying of Primorie, of the country on the river Amur, and of the Sakhalin island since the XVIIth century. Next is the report by R. V. Kozyreva (pp. 49–72) on the excavation of the 'neolithic' settlement Starodubskoe II on the Sakhalin, dated to the end of the second and early first millennium B.C. Connections with and similarities to the coeval cultures of Primorie country have been pointed out. A settlement of the same period on the Pkhusun Bay has been investigated by A. P. Okladnikov and described by him (pp. 73 ff.). A report on the investigation of that site by the same author appeared in vol. 1 of *Drevnyaya Sibir* (Novosibirsk 1964, pp. 73–83); remains found on the site were of the turn of the second and first millennia B.C. and after. It was mentioned in my first report (*Bulletin* 6, p. 128).

G. I. Andreev (*SA* 1958 (4), pp. 10–22) discusses topics relating to the chronology of the 'Shell-Heaps culture' in the southern part of Primorie, and their division into periods; according to him, the culture did not appear before the end of the second millennium and had developed during almost the whole first millennium B.C. The same author reports on the excavation of a settlement of the late stage of the culture (7th to 3rd centuries B.C.) situated in the Bay of Peter the Great west of Vladivostok.

Results of investigations at a number of settlements on the river Amur in the region of Khabarovsk and Komsomolsk of the Iron Age, some as late as of the 4th to 2nd centuries B.C., have been briefly described by A. P. Derevianko (*SAS* 2, 1966, pp. 229–242), and again by the same author jointly with E. I. Derevianko (*AO* 1966, pp. 173 ff.). Of interest is the settlement at Poltso near Kukelevo considered to be of Iron Age date, the 6th to 5th centuries B.C. Charcoal taken from the layer, at the depth of 1 to 1.5 m. has been determined

by Carbon 14 as 980 B.C. (LE-652). Results of excavation at another settlement in the valley of the Amur, at Voznesenovka near Komsomolsk have been published by A. P. Okladnikov (*AO* 1966, pp. 175–178). Several Neolithic and two Iron Age layers have been distinguished.

It is of interest to note that Carbon 14 determination of the 'Neolithic' settlement at Polyakovo on the Zeya (see my first report, *Bulletin* 6, p. 129) is 660 B.C. (LE-675; *SA* 1969 (1), p. 257). The site belongs to the 'Neolithic' culture of the basin of the middle Amur, which was different from the 'Neolithic' culture characteristic of the lower Amur; a distance of about 600 km. lies between these two areas.

The results of the excavation of Starodubskaya II on the Sakhalin, mentioned above, and Susunskaya on the same island, have been reported by R. V. Chubarova (*KSIIMK* 71, 1958, pp. 119–128), who also published a map showing the geographic position of these two, and thirteen similar, sites on the island (fig. 38, p. 120), all of the same period, the early first millennium B.C.

Finally, two western publications of works by A. P. Okladnikov, translated into English, should be mentioned, both already referred to in my second report (*Bulletin* 7, p. 83). Both contain chapters devoted to the archaeology of Siberia and the Soviet Far East, namely chapters V–VII (pp. 34–56) in *Ancient Populations of Siberia and its Cultures* (Cambridge, Mass., 1959); and chapter IV (pp. 84–156) in *The Soviet Far East in Antiquity* (Toronto 1965).

Cultural Evidence from Oldbury

by DESMOND and ANN COLLINS

Description of the Site

The site investigated is west of the village of Ightham in Kent (Fig. 1). A small valley, now dry but with a typical water-cut profile and section, runs N.N.E. from the plateau of Oldbury Hill at 500 feet O.D., down its north-eastern side between the hill and a spur (Fig. 2). The hill is part of the Lower Greensand ridge which stretches from east Hampshire to Folkestone on the Kent coast and which lies between the North Downs and the Weald; the ridge has been left upstanding by erosion of the Weald Clay to the south and the Gault Clay to the north—all the strata dipping northward as part of the Wealden anticline. At Oldbury the deposits are all of Lower Greensand age but the Gault and Chalk are only a short distance to the north. The Geological Survey map records outcrops of chert in several places on Oldbury Hill, which were the nearest source of raw material for the manufacture of stone tools.

The valley may be regarded as the course of an obsequent stream on the dipslope of the Lower Greensand ridge draining north-eastwards into the clay vale (Gault strata). When active it possibly joined the Darent. The valley presumably became dry due to a lowering of the water-table in late- or post-Pleistocene times.

In this region the Lower Greensand consists of two strata. The upper part is so hard and concreted as to resemble ironstone. Local names for this are the Oldbury stone and the Ightham stone. Under these are the softer beds of sand, called the Folkestone beds. These erode easily and vary in colour from brilliant white to orange.

Rockshelters still exist at the present day at 500 feet O.D. where the Oldbury stone has been left exposed and overhanging high in the west side of the valley. These result from downcutting of the stream and slope denudation of the softer Folkestone beds. Quarrying has altered their appearance and removed almost all traces of Oldbury stone from the spur lying south-east of the valley.

A.J.C.

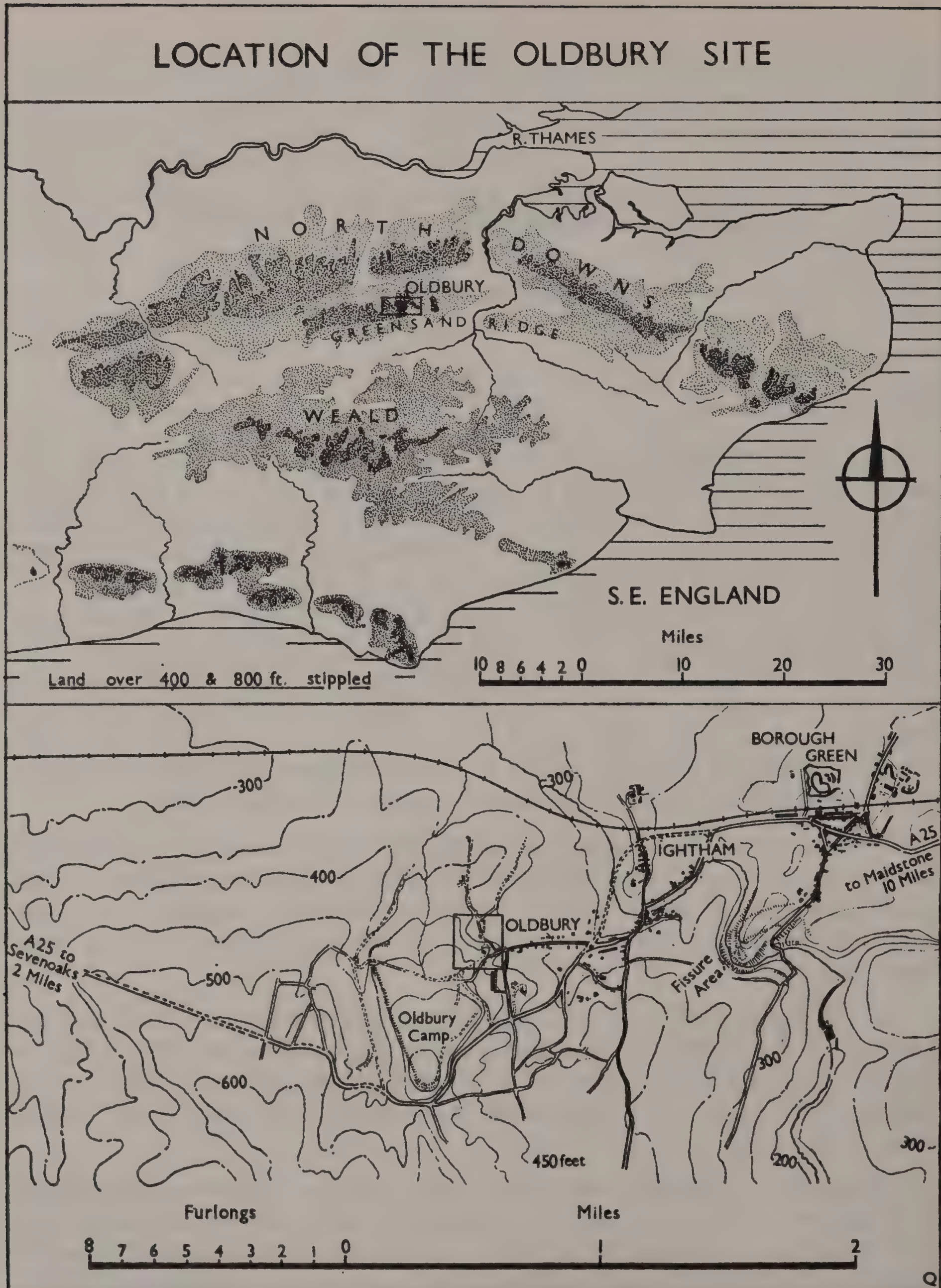

Figure 1 Location of Oldbury

Based upon the Ordnance Survey Map with the sanction of the Controller of H.M. Stationery Office, Crown copyright reserved.

History of Research

Early investigations in the Ightham area were above all the work of Benjamin Harrison, who is remembered today almost exclusively for his claims concerning the artefactual nature of 'Eoliths'. Harrison collected material of all periods in this area, and one of his most valuable discoveries was that of cordiform hand-axes near Oldbury Hill, in the vicinity of the 'rockshelters'. These were recognised as Palaeolithic cave types.

This discovery was followed in 1890 by organised excavation under the auspices of the British Association. Harrison directed the work, and was encouraged and assisted by Sir Joseph Prestwich, Sir John Evans, Professor Rupert Jones and other eminent men of the time. According to his report to the British Association meeting at Cardiff, the area immediately adjacent to the best-known surviving rock overhang was shown to be devoid of ancient deposits and holes were started on the slope and in the valley below. He adds that the hard-packed rocky filling in the valley was too much for the workmen and the digging was abandoned, without any archaeological discoveries.

The report becomes obscure at this point and it is stated that the remainder of the digging took place about 50 yards to the south-east. As will be seen later this appears to be a mistake. Whatever may be the case, this latter work produced a large collection of stone artefacts (49 implements and 648 flakes according to Harrison). As a result the site has been occasionally quoted since as Palaeolithic or more specifically Mousterian. The artefacts found were mostly presented to the British Museum in 1893 and have been analysed below.

A little amplification of the scanty data on the 1890 work was included in the biography of Benjamin Harrison by his son Sir Edward Harrison[1], who also later wrote an article in *Archaeologia Cantiana*[2]. It is in the latter work that a plan appears, suggesting that the excavations were beside a small lane, itself joining at right angles the lane from Ightham to Oldbury village at a point close to Oldbury Hatch. Subsequently the Ordnance Survey marked a symbol for the archaeological discoveries of 1890 at a point beside the lawn at Oldbury Hatch, now occupied by a kitchen garden (immediately adjacent to site N of our work). Another interesting account is by Bennett[3].

In this century very little attention has been paid to the site, and archaeologists have become increasingly resigned to the virtual absence of Mousterian cave occupation in Britain comparable to that of France. Oldbury was briefly discussed by Cornwall[4] and Pyddoke[5]. I also understand that the squared cutting made near site N and shown on the plan is a trial trench of Cornwall's.

1 Harrison, Sir E., *Harrison of Ightham* (O.U.P., 1928).

2 Harrison, Sir E., 'Oldbury Hill, Ightham', *Arch. Cant.* 45 (1933), 142.

3 Bennett, F. J., 'Ightham: the Story of a Kentish Village', *The Homeland Association Ltd.* (1907).

4 Cornwall, I. W., *Soils for the Archaeologist* (Phoenix, 1958).

5 Pyddoke, E., *Stratification for the Archaeologist* (Phoenix, 1960).

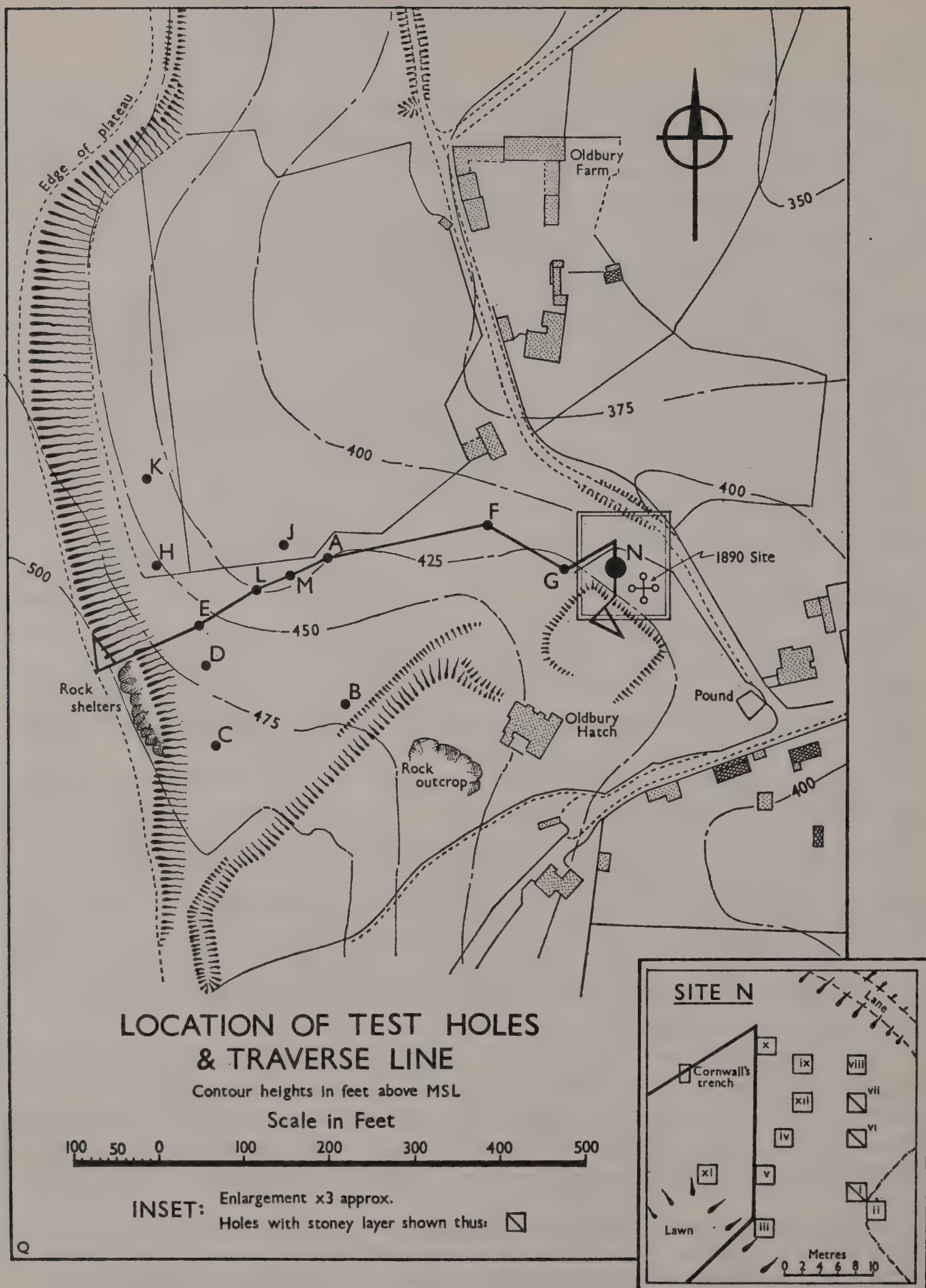

Figure 2 Map of the area investigated, with location of test-holes
Based upon the Ordnance Survey Map with the sanction of the Controller of H.M. Stationery Office, Crown copyright reserved.

About $1\frac{1}{2}$ miles east of Oldbury, a series of fissures were discovered in the Lower Greensand rocks of Basted quarry (NGR 604564) near Ightham, and published by W. J. Lewis Abbott and E. T. Newton[6]. Abbott's account of 1894[7] mentions a wide range of fossils including plants, insects, mollusca, amphibia, reptiles, and birds as well as mammalia such as mammoth, woolly rhino, bear, and various bats. In the *Quarterly Journal* of the Geological Society for 1899, Newton[8] specified: *Lepus variabilis* (alpine hare); *L. cuniculus* (rabbit); *Spermophilus erythrogenoides* (suslik); *Mustela putorius* (polecat) and *M. vulgaris* (weasel); *Canis lupus* (wolf); *Felis catus* (cat); *Meles taxus* (badger). The microtine fauna was dealt with in the Proceedings of the Geological Association for 1910[9]: *Dicrostonyx* (i.e. *D. torquatus*, banded lemming) and *Lemmus* (? Siberian lemming)—the two living tundra forms; *Arvicola abbotti* (a water vole) and five species of *Microtus* including the common forms *M. agrestis* and *arvalis*, as well as *M. ratticeps* (a snow form), *M. anglicus* and *M. corneri*.

The possibility that the rockshelter area might be associated with some trace of fauna, or that the fissures might yield stone tools greatly increased the interest of the area. It is remarkable that the fissures on faunal grounds and the Oldbury Hill stone tools an archaeological grounds are both attributable to the early part of the last glaciation.

D.M.C.

Stratigraphy and Excavation

From accounts of quarrying at Oldbury Hill, it seems likely that the capping of Oldbury stone was carried back to its present position quite recently. It is not therefore surprising that on the slope immediately below the 'rock-shelters', the Folkestone sands are exposed and are eroding away in many places. No convincing talus deposit of ancient date or with ancient artefacts has been found along the present slope.

A series of test holes was sunk near the foot of the east-facing slope (Fig. 2) at points C (extreme south); D; E; H and K (northernmost point tested). Test holes J; L and M were in the lowest part of the dry valley. On the east side of the valley were holes A and B and towards the lane and site N, holes F and G provided intermediate points for a traverse (Fig. 3). These were all dug with a mechanical excavator but E was enlarged, regularised by hand and subsequently drawn and photographed.

[6] Abbott, W. J. Lewis, and Newton, E. T., 'Excursion to Basted and Ightham', *Proc. Geol. Assoc.* 13 (1893), 157.

[7] Abbott, W. J. Lewis, 'The ossiferous fissures near Ightham in the valley of the Shode', *Quart. J. Geol. Soc.* 50 (1894), 171.

[8] Newton, E. T., 'Additional notes on the Vertebrate fauna of the rock fissures at Ightham', *Quart. J. Geol. Soc.* 55 (1899), 419–429.

[9] Newton, E. T., 'The Microtinae from the Ightham fissures', *Proc. Geol. Assoc.* 21 (1910), 494–496.

The stratigraphy of the soundings at the foot of the slope was in broad outline the same in each of the five holes: a leaf-mould humus; a buff or light grey leached sand; a purple-brown hard pan; a brown deposit, stony in every sounding except C. This basal deposit rested on the lower Greensand, usually a startling white fine sand.

The thicknesses were as follows, all in cms.

	C	D	E	H	K
Leached sand	50	64	70	70	60
Basal deposit	170	170	100	90	50
Total	240	274	210	252	130

While the basal deposit in C was almost stoneless, D and E test holes included very angular boulders over a metre in length. This basal deposit was very varied in colour, sometimes predominantly brown sometimes orange; it was clearly iron stained and not leached. The angularity of the stones seems to suggest intensive frost shattering at the time the deposits were forming. Perhaps also considerable humidity is implied by the size of the pieces. Stones occasionally present in the upper strata such as the leached sand were more rounded.

The soundings in the deepest part of the valley, L and M, exhibited a simpler stratigraphy. The basal hillwash deposit was capped only by 10 cms. of humus. Evidently it filled a sharply-incised valley, and its thickness was 280 cms. at L and 180 cms. at M. The deposit was more stony at the base, and in L it was more angular at the base and less angular at the top. The sounding at J was not quite consistent with the others—40 cms. of stony clay at the base and 50 cms. of sandy clay above it are presumably equivalent to the usual basal deposit but more clayey. Over these were 40 cms. of brown sand and 40 cms. of humus and soil which are more difficult to interpret. The brown sand is possibly a lateral equivalent of the buff grey sand, but not strongly leached. The upper soil was perhaps of agricultural origin.

To the west of the dry valley, the sounding at A showed Greensand beneath 15 cms. of leaf mould, but some kind of iron alteration or staining had taken place. At B 100 cms. of leached sand overlay a hardpan and the normal Greensand. A similar stratigraphy to that below the rock shelter on the west, was revealed to the east at locality F. Here the basal deposit, a stony hillwash, was 70 cms. thick and the grey buff sand 80 cms.

Finally in locality G as in several of the archaeological cuttings of site N (notably XI, V and IV) a little to the east, the Greensand was overlain by 110 cms. of discoloured sand, and there was no trace of basal deposit or leached series. A traverse is shown in Fig. 3.

Locality N, which is about 440 feet O.D. altitude, was excavated by students in a series of two-metre-square cuttings, laid out in a grid as shown in Fig. 2 (inset). None of these revealed a great depth of deposits. In cuttings III, IX, X and XI were found different degrees of leaching comparable to that on

the west side of the valley. IV, V and XII had a depth of discoloured sand, clearly disturbed. II had only modern rubbish above the Greensand, and in our opinion marks the probable edge of Harrison's excavations. VIII revealed the foundations of a relatively recent structure of brick and stones as well as a mass of tiles. It may conceivably be part of the kiln which is mentioned as being in the locality (some flints are labelled kiln field). There are traces of burning and reddening in several adjacent areas. Cuttings I, VI and VII revealed a stony layer.

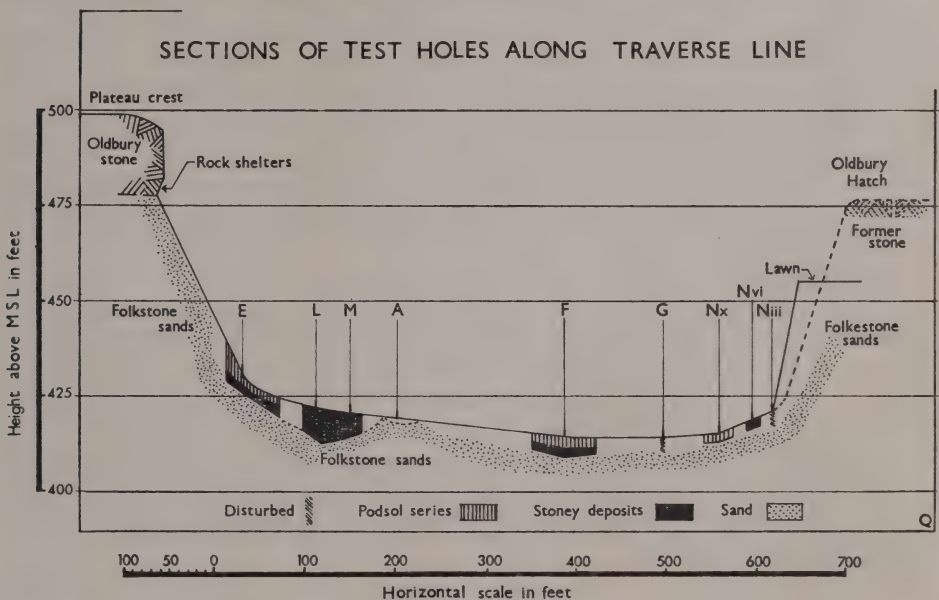

Figure 3 Traverse from 'rockshelters' to site N

The interpretation of the strata to the west of the valley immediately below the rock overhang of the plateau of Oldbury Hill is fairly simple. The first event must have been the cutting of the valley. Then the filling of this with the stony basal deposits took place, largely by the process of rock shattering round the perimeter of the plateau. Next a quantity of sand and silt washed down the valley sides was deposited, usually over 50 cms. thick. This has been heavily leached and a hard pan has formed beneath it. The whole process is typical of podzol formation in acid soil areas under heavy rainfall and light coniferous or heathland vegetation. The podzols of C, D, E, H and K were not however typical since the A2 horizon (leached sand) exceeded considerably the normal 25–30 cms. This great thickening—to over 70 cms. in some cases—is presumably the result of continued sedimentation while the leaching was in progress.

The basal stony deposit reached its greatest depth in the centre of the valley. Nowhere were any stone artefacts found in these deposits, or any trace of fauna. Some flakes were however found in the overlying podzol series, notably in sounding E. They seemed to be post-glacial, Neolithic or Mesolithic types and had a quite different patina from those of site N. The obvious dating is thus that the podzol series occupies a large part of the post-glacial, and the basal deposit is of last glacial date.

The most important conclusion from the east side of the site may be drawn from the presence of a stony deposit in F and N I, VI, etc. Such a geological stratum (beneath the podzol in F) can only indicate that these points were once at the foot of a slope, overhung by a rock stratum. The rock plateau must once have capped the spur now leading out to Oldbury Hatch. There is reason to believe that the rock capping was extensively quarried from here in the nineteenth century and even earlier. The stony layer in N I, VI and VII contained flakes and tools unmistakably characteristic of the Mousterian culture phase, also known from Harrison's work. Unfortunately there is no geological indication of its exact antiquity, but it must presumably date from the first half of the last glaciation.

It seems to us extremely unlikely that no trace of the stone tool assemblage would be found in the basal layer of sounding E to H if this was contemporary with that of N; perhaps it was later in the last glaciation and the cutting of the valley was not complete in Mousterian times. Stone tools with the 'Mousterian' patina were found in podzolised layers on site N and were presumably derived. Other cuttings revealed only discoloured sand, and a handaxe as well as other tools were found in such a situation. We suspect this is recent sludge material, resulting from disturbance in making the lawn above the site or possibly in digging for building stone.

D.M.C. and A.J.C.

Cultural evidence from Oldbury

(i) STONE ARTEFACTS (Figs. 4, 5 and 6)

The excavations of 1965 recovered 106 flakes from site N of which 72 were *in situ* in the stony layer of cuttings I, VII or VI. One typical handaxe and one broken example were found, as well as three less-typical biface pieces. Two of the latter were from the stony layer, but the remainder were in a secondary position. A further six characteristic tools were recovered, of which two were from the stony layer. The highly-characteristic patina from the tools found *in situ* is closely matched on the remaining pieces, and is quite different from that on Neolithic tools found in the area. The 1965 material is therefore treated together.

Further comparison with the artefacts from Harrison's excavation of 1890 (accessed in the British Museum as 93 3-23) revealed that these too are easily placed in the 'stony layer' patination group. This patina is most often of a bluish enamel appearance with white 'basket work' (type 1); but this also grades into a yellowish-green (type 2), and at the other end a pure white matt (type 3), which in turn grades into a matt white with partly-decomposed surface (type 4). There were 211 flakes in group 1 which I studied in detail, and approximately 500 in all the groups together. Twelve handaxes were also present in the assemblage, and nineteen retouched pieces qualifying as tools.

The total number of handaxes from the Oldbury region is much larger. The figure of twelve for the 1890 collection is misleading since Harrison seems to have retained some handaxes and given others to collectors such as Lord Avebury. Most of these were subsequently deposited in the British Museum or Maidstone Museum. Including eight from Maidstone Museum I have taken details of 39 which were all found in Harrison's excavation or are labelled 'rockshelters'. This sample is sufficient to provide a fair indication of the types made and for simple metrical work. There are also many cordiforms coming from localities not on the east side of Oldbury Hill betraying more general activity in the area in Pleistocene times, and the site of Stonepits to the west may have been as rich as Oldbury and is worth further investigation.

(ii) Handaxes and the Mousterian of Acheulian Tradition

The presence of handaxes alone indicates the cultural affinities of the Oldbury assemblages. The cordiform handaxe is characteristic of the Mousterian of Acheulian Tradition (here abbreviated to M.A.T.), recognised and named by Peyrony[10] from layers G and H of the type site, le Moustier, in the abri Peyrony or lower shelter. This cultural entity has been more closely defined by Bourgon[11] and Bordes[12]. According to all these workers it is a culture tradition, dating from the first half of the last glaciation and descending from the Acheulian. Its relationship to the 'Micoquian' and latest Acheulian are somewhat unclear, but it is very abundant compared with the 'Micoquian' of layer 6 of la Micoque which has no close parallel in an adequately dated assemblage elsewhere in France or indeed western Europe. Unlike Peyrony and Breuil, Bordes includes in the M.A.T. a number of cordiform assemblages from northern France, which were associated with Levallois flakes and previously regarded as 'Levalloisian V', e.g. St. Just en Chaussée and le Tillet (latest series). The handaxe is almost unknown in other parts of the last glacial 'Mousterian' complex, for example the

[10] Peyrony, D., 'Le Moustier, ses gisements, ses industries, ses couches géologiques', *Revue Anthr.* 40 (1930), 48–76, 155–176.

[11] Bourgon, M., 'Les industries Moustériennes . . . du Périgord', *Archives de l'Inst. de Paléont. Humaine* 27 (1957), 86–104.

[12] Bordes, F., 'Les gisements du Pech de l'Azé (Dordogne)', *L'Anthropologie* 58 (1954), 401–432; 59 (1955), 1–38. 'Mousterian Cultures in France', *Science* 134 (1961), 803–810.

Ferrassie and Quina types or comparable assemblages of Riss (penultimate glacial) date, which have been grouped as Charentian.

The concept of a handaxe is widely used but rarely defined. I include generally flattened tools, bifacially or part bifacially flaked, roughly symmetrical about a long axis and roughly lens shaped (i.e. biconvex) in cross section. Typically they have a sharper end, often pointed—the tip; and a blunter end—the butt. The widest point may be close to the middle of the long axis but is usually nearer the butt. The edge from the tip to this widest point, I refer to as the side. The side can be concave or 'CC' (Micoquian type); straight or 'S' (lanceolate) or the third possibility convex—'CV'. The latter form may be widest near the middle (limande or ovate) or more than 62% of the way from the tip to the butt. It is this last group (the cordiforms) which characterises the M.A.T. The terms lanceolate, cordiform, etc., follow the usages proposed by Bordes.[13]

Acheulian assemblages earlier than the last glaciation are usually distinguished by the presence of straight or concave-sided handaxes. This can be expressed conveniently by the CV index$=\frac{\text{Total CV sides.}}{\text{CC+S+CV}}$ The CV index for the lower middle gravels of Barnfield Pit, Swanscombe, is only 30.6, while for Cuxton it is 59.2. A CV index below 75 is indicative of a non-MAT assemblage; however some Acheulian assemblages have a high CV index and yet are probably not of last glacial date. Examples include the type site assemblage 'Atelier Commont' found at St. Acheul which gives a CV index of 82.5 on 90 specimens, and the Acheulian of Bowmans Lodge 93.9 on 33 specimens.[14] These high CV indices which do not fall in the last glaciation seem to belong to episodes of early- and mid-Riss (penultimate glaciation) date.

Several typological features distinguish these from the cordiforms of last glacial date. The frequency of cleaver tips is 33.3% for Bowmans Lodge and 14.2% for St. Acheul, but very low in M.A.T.: 5.7 for Pech de L'Azé layer 4 (122 specimens); 0.0 for le Tillet (20); 4.6 for Oldbury (43). Similarly a twisted profile was present in 21.3% of the handaxes from Bowmans Lodge, and 7.8 from St. Acheul, but completely absent in M.A.T. assemblages: le Tillet, Toutifaut, Pech de L'Azé, etc.

Probably the most useful single indication for distinguishing the M.A.T. assemblages from those of earlier date is by the greater elongation of handaxes in the latter. For this purpose an elongation index such as $\frac{100 \text{ breadth}}{\text{length}}$ is most convenient, a comparable index having been used by McBurney[15] and Bourgon[16].

[13] Bordes, F., *Typologie du Palaeolithique Anc.* (Delmas, Bordeaux, 1961).

[14] Tester, P., 'Palaeolithic flint implements from the Bowmans Lodge gravel pit, Dartford Heath', *Arch. Cant.* 63 (1950), 122–134.

[15] West, R. G., and McBurney, C. B. M., 'The Quaternary deposits at Hoxne', *P.P.S.* 20 (1954), 131–154.

[16] Bourgon, M., *op. cit.* fn. 11.

McBurney quoted the highest Acheulian figure as 61.53 (Hoxne 47 specimens) and accepted abri Olha with 69.40 as M.A.T., as well as higher values of 72.44 (la Rochette) and 72.62 (L'Hermitage, Belgium). This boundary between 61 and 69 would place Bowmans Lodge (71.5) well in the M.A.T., which is surely not its correct place. Also as typical an Acheulian as Swanscombe upper middle gravels layer E[17] has 67.0 index, calculated on 74 specimens. Thus values up to 70 are normally Acheulian.

M.A.T. values are usually higher:

le Tillet (early M.A.T.) 74.75;
Toutifaut 73.50;
Oldbury 75.78;
le Moustier G 73.5 after Bourgon and 77.27 after McBurney;
Combe Capelle, upper shelter 73.5 (Bourgon); 74.64 (McBurney).

Accordingly, a provisional boundary of 72 seems more applicable; but I am not sure this would always give a satisfactory result—Bourgon gives 70.5 for Couze, a typical M.A.T. cave site. A wider bracket is probably more suitable here—below 68 for Acheulian, over 72 for M.A.T., and intermediate values assigned by further investigations into typical quantitative features.

The convex handaxes of Bowmans Lodge and St. Acheul include a higher proportion of ovate types, and consequently another metrical index of the length from the tip along the long axis to the widest point compared to the total length $\frac{(100 \text{ length to tip})}{(\text{ total length })}$ differs from the M.A.T.: 60.6 for St. Acheul and 61.3 for Bowmans Lodge compared with values over 63 for the M.A.T. At the same time the elongated forms of cordiform and the limande (as opposed to ovate) can be distinguished on the $\frac{100\text{ B}}{\text{L}}$ index, and these are commoner in the Acheulian.

It is often supposed that the handaxes of an M.A.T. lack the regular presence of non-CV sides, i.e. that the CV index is virtually always 100. In fact values are regularly nearer 90 or even below.

Site	*Sample*	*CV index*	*Reference*
Pech de l'Azé 4	122	92.5	*L'Anthropologie* 58, 401–432
Le Tillet	20	92.5	*Archives de L'Inst. de Palaeont. Humaine* Memoire 26, 357–383
Toutifaut (nr. Bergerac)	20	97.5	
Oldbury	43	88.4	
La Chaise (Charente) 4	13	92.3	*Bull. Soc. Prehist. Fr.* 49, 528–531
La Chaise (Charente) 3	16	78.2	*Bull. Soc. Prehist. Fr.* 49, 528–531
La Chaise (Charente) 1+2	11	80.8	*Bull. Soc. Prehist. Fr.* 49, 528–531
Bowmans Lodge	33	93.9	*Arch. Cant.* 63 , 122–134
St. Acheul	90	82.5	*L'Anthropologie* 57, 1–45
Cuxton	174	59.2	*Arch. Cant.* 80, 30–60
Swanscombe E	74	49.3	*Royal Anth. Inst.* Occ. Paper 20, 19–62

[17] Wymer, J., 'Excavations at Barnfield Pit 1955–60', *The Swanscombe Skull*, Royal Anthr. Inst. Occasional Paper 20 (1964), ed. C. D. Ovey, 19–62.

One further feature sometimes serves to distinguish the M.A.T. This concerns the morphology of the butt. In the pre-last glacial Acheulian the butt is usually rounded in face view, continuing the curve of the sides past the widest point and round the base. By contrast, in pre-last glacial assemblages a common feature is a sharp angle between the sides and the butt, which is actually straight or in a gentle arc. The most classic example is the triangular handaxe, characteristic of le Tillet. Actually many triangular handaxes (accepted by Bordes[18]) have very slightly convex sides—otherwise the CV index of assemblages including triangular handaxes would be much smaller. Other handaxes with the 'angled' butt are strongly convex sided and rounded at the tip, presenting a face view resembling the cross section of a loaf. Some of the most classic examples of this kind come from pits at Little Paxton near St. Neots in Huntingdonshire[19] where they are well dated to early in the last glaciation. Figs. 4,5 and 6,17 from Oldbury approach this type.

For want of a better name we refer to this angled butt as of Paxton type; its frequency can be expressed as an index. This Paxton index very clearly picks out one part of the M.A.T. with a 25% or more frequency, and eliminates many pre-last glacial assemblages with zero index, including St. Acheul; Cuxton; Cagny; le Tillet (white series); Swanscombe layers F and C. Cases of Paxton butts of pre-last glacial date are Bowmans Lodge, 2 out of 33—a very small sample; and Swanscombe E—5.4% or 4 out of 74, inexplicably and anomalously high. The Paxton index is highest in le Tillet (late series)—60% or 12 out of 20; Toutifaut 25% and Oldbury 25%. Paxton types were certainly present in Pech de l'Azé 6.6% and in le Moustier G, perhaps 5.4%.

It is therefore apparent that the various metrical and typological features of pre-last glacial handaxe assemblages, usually called Acheulian, are somewhat variable. The last glacial M.A.T. handaxes are more consistent, with the following characteristics: CV more than 75; $\frac{100\text{ B}}{\text{L}}$ more than 70; $\frac{100\text{ LT}}{\text{L}}$ more than 62; cleaver frequency less than 10%; Reverse-S less than 5%. Oldbury includes many typical cordiforms and can be included confidently in the M.A.T., even though its CV is 88.4 which is a little below the more typical figure of 92. There was only one feature among the 43 handaxes which contrasts with all other M.A.T. assemblages, the frequency of reverse-S twist profiles, 6 out of 43 or 14%. Twist profiles are otherwise almost universally absent. I suspect that most of the six are derived Acheulian specimens; none came from the 1965 excavation or Harrison's 93 3–23 series. Most were from the Sturge collection, and the most typical example came from the Fenton collection and is probably wrongly marked.

[18] Bordes, F., *op. cit.* fn. 13.

[19] Paterson, T. T., and Tebbutt, C. F., 'Studies in the Palaeolithic Succession in England. III St. Neots', *P.P.S.* 13 (1947), 37–46.

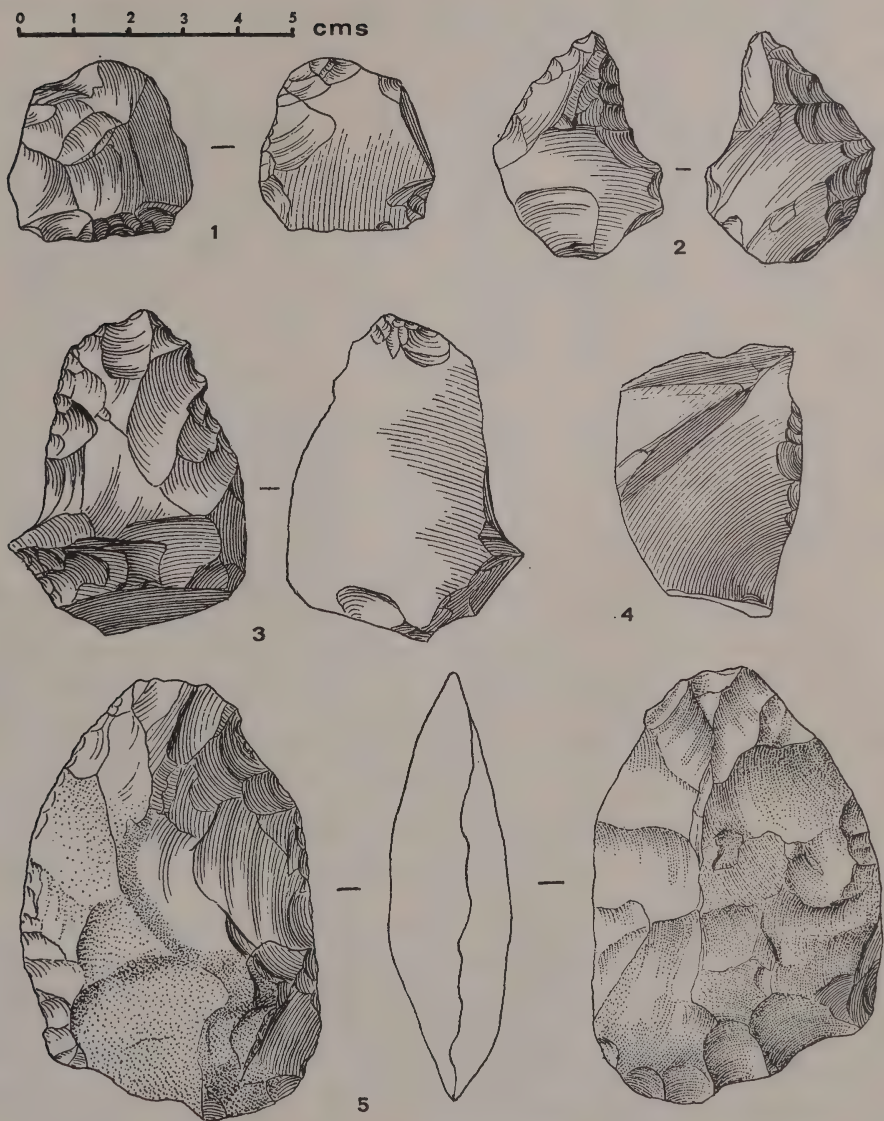

Figure 4 Tools from the 1965 excavation.

Values are given below for the typological and metrical features of handaxes in the M.A.T. These include values for Oldbury; le Tillet; Pech de l'Azé and Acheulian assemblages such as Bowmans Lodge, St. Acheul and Swanscombe layer E, as well as average values and limits for the M.A.T.

	CV	100B L	100LT L	C1	Reverse-S	Paxton	100Th B
Oldbury	88.4	75.8	63.2	0	?14 (0)	25	39.6
le Tillet (latest series)	92.5	74.8	69.8	0	0	60 (25)	30.3
Pech de l'Azé layer 4	92.6	77.1	61.3	5.7	0	6.6	44.5
le Moustier layer G	—	73.5	—	?0	?0	—	35
M.A.T. limits	75–100	70–85	60–70	0–10	?0	?5–60	30–45
Bowmans Lodge	93.9	71.5	61.3	33.3	21.3	6	41.6
St. Acheul	82.5	63.3	60.6	14.2	7.8	0	51.5
Swanscombe layer E	49.3	66.6	67.5	4.4	0	5.4	55.2
Acheulian limits	25–100	50–72	60–70	0–40	0–25	0–6	40–60
la Micoque layer 6	41.2	63.5	67.7	0	1.9	?2.8	48.4

(iii) Flake Tools and Waste Flakes

No cores have been recovered from Oldbury and the core technique is accordingly difficult to discuss. Presumably a number of flakes were obtained in roughing out and finishing handaxes. One handaxe seems to have been made on a small bi-polar Levallois core (Fig. 6, no. 14) and I think this practice may account to a large extent for the absence of cores. Some undoubted Levallois flakes are known from Oldbury but the index is not high. It is significant that a number of tools are made on Levallois flakes. The Levallois index calculated on the total of flakes including the waste flakes and trimming flakes is low, perhaps about three, but if the trimming flakes are excluded it would presumably rise (by a factor of 5–7) to 15–21 or more, depending on what was excluded from the trimming flake category.

The tools from the 1965 excavation are all illustrated (Nos. 1–12). Two would be classed in the Bordes system as racloirs (Nos. 12 and 7); the latter is pointed but only because the tool is broken; one is convex the other straight convex. No. 4 is just acceptable as a racloir 'à face plane' (type 25) but nos. 6 and 11 are very obviously bifacially retouched with rather abrupt flakes not scaly in character. No. 3 might be just acceptable as a racloir, but it is a surface find. One good Acheulian notch or hollow (no. 10) was found. Flake tools of well-characterised form are thus commoner in the 1965 series than handaxes. About six flake tools against two handaxes was the ratio. The 1890 excavation series had twelve handaxes to nineteen flake tools.

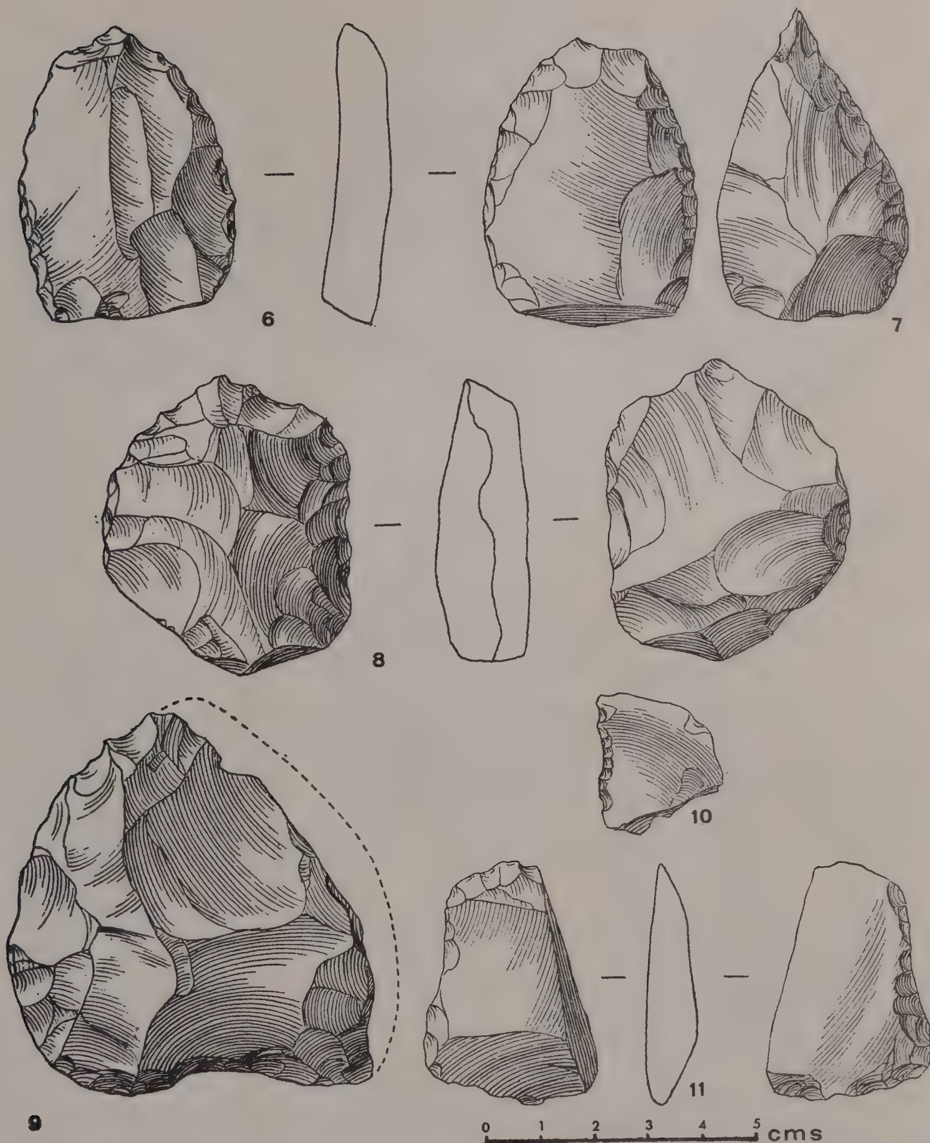

Figure 5 Tools from the 1965 excavation.

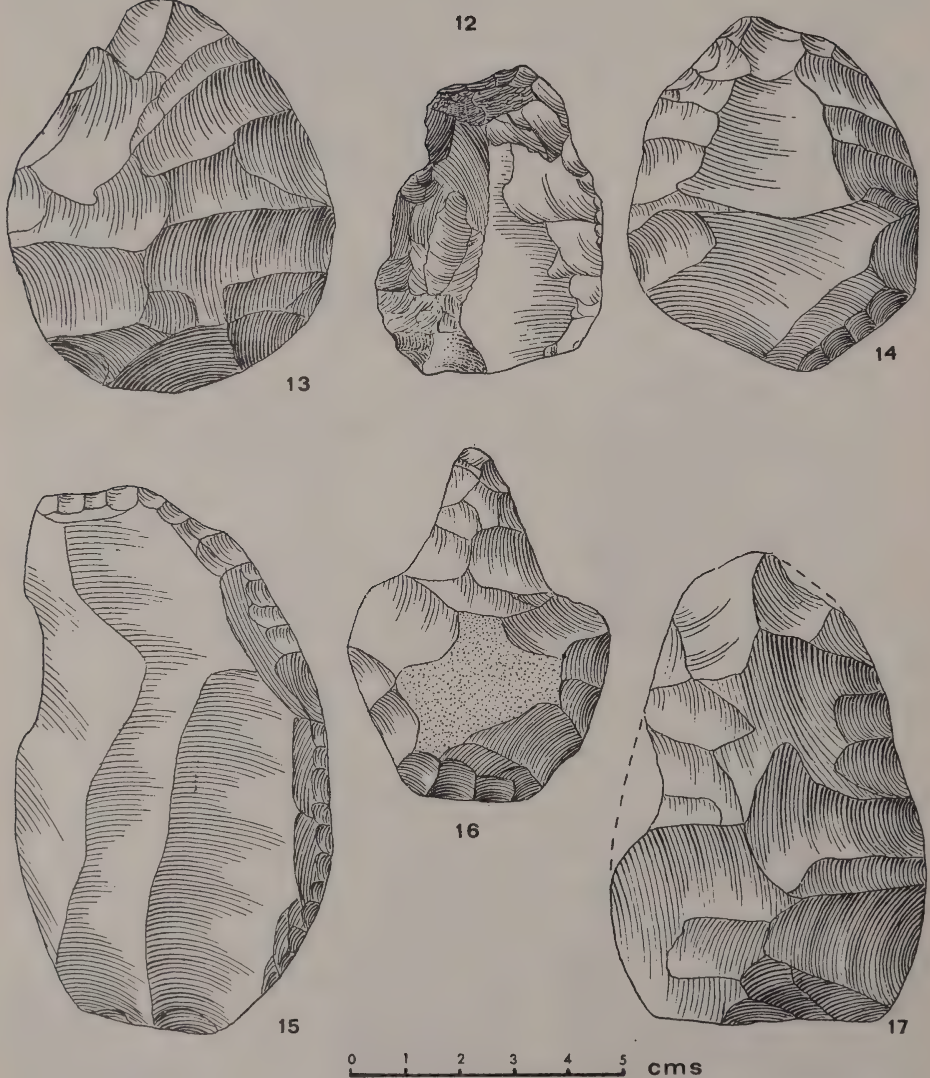

Figure 6 No. 12 from excavation; nos. 13–17 tools found in earlier work.
No. 16 handaxe of 'Paxton' type; no. 17 handaxe of 'Oldbury' type with borer tip; no. 13 handaxe with burin on tip; no. 14 handaxe made on small bipolar Levallois core; no. 15 backed knife.
Nos. 13, 14, 16, 17 British Museum; no. 15 Maidstone Museum.

Perhaps the most characteristic feature of the 1965 series is that the incidence of partly or wholly bifacial pieces, 7 out of 12, is very high. In all the series together, the bifacial element is also predominant.

The flake tools were characteristic of the Acheulian tradition in the negative sense that Quina racloirs, limaces and other typical Charentian forms were absent. The classic Mousterian point and good denticulate tools were also absent. Normally cordiform handaxe assemblages include backed knives on flakes or blades, as well as cortex backed types. The only typical backed knife (Fig. 6, 15) is one in Maidstone Museum marked Oldbury, but the cortex backed knife is found in the 1890 series. Fontmaure is however another example of a site where the backed knife was rare or absent, and in view of other similarities to Oldbury, the two are probably from the same phase of development, and this is one with a very low frequency of backed knives.

Harrison's series included a large quantity of flakes, mostly small trimming flakes. These belonged to four main patination groups described previously. The number of flakes of group 1 preserved in the British Museum was 211, only 90 having butts. From the 1965 series we have 11 illustrated tools and 106 flakes. The waste flakes were found as follows, those in brackets not found in situ in a stony layer: Cutting I=19; II=(5); IV=(7); V=(4); VI=4; VII=49; VIII=(14); IX=(3); X=(1), 106 flakes—72 reliably in situ. These flakes are analysed below. As stated previously a number of Levallois flakes were present, but very rare compared with trimming flakes—about 3.3%, which might represent 'Indice Levallois' 15–23 if the trimming flakes constituting about 85% were removed. The strict facetting index (IFs) based on 90 flakes with butt was 13.2 on all flakes, perhaps rising to 40, and the wider index (IF1) was 19.8 rising to 55, both assuming two-thirds of the flakes to be waste, a lower proportion in the case of flakes with butts. The laminar index is certainly low—one blade out of 91 flakes—even if 90% of the flakes were regarded as trimming flakes, and the I.1am. would not exceed 10. The cone often found at the point of percussion on Clactonian flakes was totally absent, but a point of percussion diffused in an arc was quite frequent—7%.

Not surprisingly the flakes in the M.A.T., coming largely from handaxes, closely resemble those from Acheulian handaxe assemblages of earlier date. I suspect that the number of flakes not derived from handaxe manufacture, perhaps made as blanks for flake tools, is so small as to be of little significance in the metrical assessment of many handaxe assemblages. It was also possible to show that Harrison's 211 flakes in group 1 had a much lower proportion of small trimming flakes. The modal length on 205 specimens suitable for measurement in Harrison's series is 30–35 mm. On 109 measurable specimens in the 1965 series, the modal length was 17–20 mm. Harrison kept nothing below 15 mm. and little below 30 mm. In spite of this disparity the two series are very comparable in most respects.

The following table indicates the similarity of the Oldbury flake assemblage to other Acheulian assemblages, and its difference from Clactonian assemblages in chunkiness or relative thickness, expressed by the R.T. index $\frac{(100 \text{ thickness})}{(\text{maximum length})}$; butt thickness and flaking angle:

Site and assemblage	Total speci-mens	R.T. index			Butt thickness		Angle	
		Mean	Mode	%<25	Mean	Mode	Mean	Mode
Oldbury	316	23.8	17.5	59.3	4.7	3	107.3	100+
Swanscombe C	235	23.4	16.2	57.8	5.4	3	105.5	95+
Hundisburg	58	21.9	16.2	70.6	6.3	4	106.6	95+
Swanscombe basal gravels	256	33.8	28.7	9.6	13.2	11	116.3	110+
Clacton	177	31.1	28.7	18.4	9.8	11	116.2	110+

Clactonian flakes, analysed in the last two assemblages, are clearly thicker and chunkier than those in assemblages where handaxes were made, and which are regarded as belonging to the Acheulian culture tradition including those with Levallois flakes such as Hundisburg. Thick flakes characterise assemblages like High Lodge of penultimate glacial date, as well as the Quina and Ferrassie group of last glacial date—indeed the whole 'Charentian' tradition, which seems to commence about the point where the Clactonian ceases.

The tools of the 1890 and 1965 series are listed below along with indices of technique:

Provisional indices: I.L. (Indice Levallois)=18
I.F.s (Strict facetting index)=40
I.F.1 (Wider facetting index including dihedral butts)=55
I.lam (Laminar index)= ?8
I. B. (Biface index)= ?37.8

It is quite apparent that with 45 tools—only 28 in the 'Essential' group—any quantitative calculations are of very doubtful validity, and the values are included in the seriation-line in brackets only for comparison.

Type after Bordes	French name+English name	1890	1965	total
1–2	Eclats Levallois or Levallois flakes	11	0	11
5	Pointes pseudo-levalloisiennes, Pseudo-levallois points	1	0	1
9	Racloirs simples droits, Straight lateral racloirs	1	0	1
10	Racloirs simples convexes, Convex lateral racloirs	4	2	6
11	Racloirs simples concaves, Concave lateral racloirs	1	0	1
13	Racloirs doubles droit-convexes, Straight-convex double racloirs	2	0	2
15	Racloirs doubles biconvexes, Biconvex double racloirs	1	0	1
18	Racloirs convergents droits, Straight convergent racloirs	1	0	1
19	Racloirs convergents convexes, Convex convergent racloirs	1	0	1
25	Racloirs sur face plane, Bulbar surface racloirs	1	3	4
9–29	Total of Racloirs	12	5	17
30–1	Grattoirs ('End scrapers')	2	0	2

38	Couteau a dos naturel, Cortex backed knife	1	0	1
42	Encoche, Notch—total	5	1	6
	(Acheulian type)	4	1	5
	(Clactonian type)	?1	0	0
43	Denticulé, Denticulate	1	0	1
45–50	Pièces a retouches, Other retouched pieces	6	0	6

Total 1–62=45; 'Essential total' (minus 1–4, 45–50)=28.

(iv) Sequence of the M.A.T., and the place of Oldbury

Bordes[20] has suggested that two types of M.A.T. exist—an earlier type A and a later type B. Type B has fewer handaxes ('seldom more than 4 or 5% and none triangular'); racloirs are reduced to 4 to 10%. Knives increase up to 20%; some are more elongated and are made on blades suggesting the Chatelperron point. Denticulates rise to 20%, and there is more laminar flaking including bladelets. Type B is regarded as later than the Wurm I-II (here= Brorup) inter-stadial, and developing into the Perigordian I about the time of the Wurm II-III interstadial (sometimes referred to as Gottweig but which most inconveniently lacks a widely accepted name).

Some suggestions for a more complex developmental sequence among the M.A.T. assemblages from cave sites have been put forward by Mellars[21], in which the Levallois index decreased and the mean length of the handaxes also decreased. The handaxe frequency and knife frequency were not subject to trends but some indication of groups or plateaux emerged.

The question of the seriation of quantitative features has been explored[22] in relation to Upper Palaeolithic assemblages from south-west France, and the construction of a seriation-line for the M.A.T. along the lines suggested by Mellars seems worthwhile. In attempting this one can either take a small number of good assemblages and try to seriate a small number of features within them very closely, or one can take many more features and assemblages and accept a lower level of consistency in the trends. Unfortunately, the published data in this field is very unsatisfactory, and Pech de l'Azé is the only site which is both rich enough to be of value and at the same time available in print with suitable quantitative data.

The seriation-line data in the table set out below shows undeniable trends. It is made up mainly of stratified sequences; 5 assemblages from Pech de l'Azé I[23]; 4 from la Chaise in the Charente (not completely published but see Bordes 1952[24]); 3 from le Moustier lower shelter layers F, G, and H; 2 from Gare de

[20] Bordes, F., *op. cit.* fn. 13.

[21] Mellars, P., 'Sequence and development of Mousterian traditions in Southwestern France', *Nature* 205 (1965), 626–627.

[22] Collins, D. M., 'Seriation of quantitative features in Late Pleistocene stone technology', *Nature* 205 (1965), 931–932.

[23] Bordes, F., *op. cit.* fn. 12.

[24] Bordes, F., 'Les industries Moustériennes de la Grotte de la Chaise (Charente)', *Bull. Soc. Préhist. Fr.* 49 (1952), 528–531.

Couze and 1 from abri Blanchard. The latter three sites are very inadequate in terms of excavation and publication, but usefully summarised by Bourgon[25]. Le Tillet early M.A.T. series[26] and la Rochette layer 7[27] are both well published, and can be fairly confidently placed at the beginning and end of the line respectively. Fontmaure lower layer[28] is interesting as it presents the best similarities to Oldbury. Thus quite apart from the probably very long time span covered by these sites (from le Tillet *c.* 75,000 B.C. to Rochette 7 *c.* 35–40,000 B.C.) there are good reasons why the seriation might not be very clear. The Ferrassie-Quina sequence in the Mousterian seems to seriate much more easily, perhaps because it is more concentrated in time and space, as is the case with the Aurignacian of the Vezere valley[29]. See table on page 176.

The frequencies in columns 6 to 9 are calculated on the base number of tools, including only racloirs (9–29); leptolithic group 30–37 including cortex knives 38; and the notch denticulate group 42–3; i.e. 9–38+42–3. The I.L. is that used by Bordes either from his own publications or Bourgon[30] as are the I.F.s; the I.Dih (I.F.1 minus I.F.s or dihedral butts) and I.lam. The handaxe lengths are from Bourgon, my own measurements, Mellars[31] or measurements taken in collaboration with the latter author.

The assemblages from la Chaise are by no means unanimously regarded as M.A.T. Handaxes are very rare and they have been attributed in part to the denticulate Mousterian and the Micoquian. Recently Prat has attributed them to later Riss times on faunal grounds. I have included them because on the grounds of seriation-line data they seem to form a possible developmental sequence leading up to Pech de l'Azé, but their position is clearly not settled.

The earlier assemblages, le Tillet, le Moustier, etc., do not show fully consistent trends. Fontmaure and Oldbury seem to be on their own as a middle phase or zone. If one assumes a breakdown in the regular occupation of the Perigord at this time and a resultant occupation of very outlying areas—Fontmaure, north of Poitiers and of course Oldbury in Kent—then a break in direct ethnic development is an easy explanation of the cultural discontinuity. Presumably several local lineages came into existence and, though all would probably follow the same general development, a series of smooth trends would not be available in the lithic cultural evidence, unless one was lucky enough to have located the particular ethnic division which gave rise to the later stages.

[25] Bourgon, M., *op. cit.* fn. 11.

[26] Bordes, F., 'Les limons quaternaires de la bassin de la Seine', *Archives de l'Inst. de Paléont. Humaine Mémoire* 26 (1954).

[27] Delporte, H., 'Le Gisement de la Rochette', *Gallia Préhist.* 5 (1963), 1–23.

[28] Pradel, L., 'The transition from the Mousterian to the Perigordian', *Current Anthropology* 7 (1966), 33–50.

[29] Collins, D. M., *op. cit.* fn. 22.

[30] Bourgon, M., *op. cit.* fn. 11.

[31] Mellars, P., *op. cit.* fn. 21.

Figure 7 Distribution of the Mousterian of Acheulian Tradition

As noted in a previous publication[32], the consistency of cultural developments evidenced by seriation-lines deduced from quantitative lithic technology presumably depends on the identification through time of the debris left by a single ethnic unit ('tribe') or a larger grouping of ethnic units in sufficiently close contact to pursue and conserve trends reciprocally. There was some evidence that local development was more fragmented and dissimilar in the Solutrean than in the Aurignacian. A distribution map of M.A.T. sites appears in Fig. 7, and indicates that the M.A.T. is potentially very informative in view of its restricted distribution. In fact, as one might expect from this localisation, a single series of trends seem to apply to the whole distribution, even though one might be able to find some trace of local sub-lines on geographical and technical grounds. Nevertheless there is no indication of two or three very dissimilar lines within the M.A.T.

Outside France, Belgium, and Britain, the existence of the M.A.T. is doubtful. Since there is no good site even in south-eastern France, the Italian sites Ponte Galeria (a cordiform exhibited in Rome) and Valle Giumentina must be regarded as doubtful. Layer 46 of the latter site did however contain material distinctly similar to that of the initial M.A.T. of le Tillet and Blanchard, and could be evidence of initial attempts to settle in Italy. The Spanish sites are also unsatisfactory—Cova Negra being the best known. The upper layer at San Isidro has M.A.T. features. The cleaver handaxes found at Castillo, Olha, etc., grouped as Vasconian have only a very doubtful similarity to types in the M.A.T. of which a really satisfactory site has not yet been identified as far south as the Pyrenees. The German sites of Balve Höhle and Rhine-Herne are not by any means typical. Perhaps Balve is also evidence of initial attempts at settlement over a wider area, since again it resembles the earliest M.A.T. Even the eastern central French sites are doubtful. Quite clearly the Belgian, northern and western French sites are the richest, and constitute the main centres.

Le Tillet is the only site in the seriation-line with many typical 'Paxton' handaxes, and accordingly I suggest that the Paxton group, commonest in England, is all initial last glacial date—perhaps *c.* 70–75,000 B.C. If Oldbury belongs to a later intermediate stage, there is no adequate parallel for such an occupation elsewhere in Britain, but I feel that Bois du Rocher, Grainfollet, Mont Dol and Cotte de St. Brelade may also go in this intermediate position, perhaps at a slightly later stage, even though they exhibit considerable differences. The characteristic borer tip (Oldbury type) handaxe (Fig.6, 16) is found at Bois du Rocher and Fontmaure. I wonder if the rare so-called Micoquian pieces from Grainfollet[33] are a form of this.

From a European point of view the M.A.T. distribution is very obviously Atlantic, and is concentrated only in the westernmost part of Europe. Many of

[32] Collins, D. M., *op. cit.* fn. 22.

[33] Giot, P. R., and Bordes, F., 'L'Abri . . . de Grainfollet', *L'Anth.* 50 (1955), 205–234.

these territories—Britain, Brittany—have not yet yielded any evidence of last glacial Charentian. It is also evident that low-lying situations were preferred to mountainous types or even high-altitude plateau sites. Most are less than 100 metres (300 feet) above sea level, and all that I know are below 500 metres (1500 feet). Charentian sites are well known over 500 m. in the Alps, e.g. Cotencher. This last point as well as more general considerations of environment is unfortunately largely dependent on how the various sites are to be dated, what environmental patterns prevailed at each period and whether the sea was lower. For example, most Quina sites in the Perigord date from a period when the sea was probably 100 m. lower and accordingly fall in a higher contour zone of contemporary environment than appears today. Grainfollet as a beach site is particularly interesting; Kents Cavern is also close to the sea.

The question of dating is not easy to fix. No C.14 dates are available for any part of the seriation-line, except Rochette 7 which as expected falls around 35,000 B.C., and sites like le Tillet are presumably outside C.14's effective range. Pech de l'Azé 7 like Rochette 7 may be confidently put immediately before the Perigordian I (in the 35–40,000 B.C. range). Bordes has favoured a Wurm I–II (=Brorup) date for le Moustier G. This would presumably space out the remaining sites roughly evenly over the entire period in question. Mellars has suggested the alternative that the whole M.A.T. of the Perigord caves is post Quina (? *c.* 48,000 B.C.). The latter view should be easily tested by a suitable C.14 programme. If true it would leave a puzzling gap of continuity between le Tillet (and presumably the Paxton group at *c.* 75,000 B.C.) and the end of the Quina (*c.* 48,000 B.C.).

An alternative is to put le Moustier G in the earliest Brorup; then the 'fragmentation' discussed above could be attribut d to Brorup-age environmental disruption—a minor version of that which characterises post-glacial times. On this hypothesis Oldbury would belong to the end of the Brorup or *c.* 58,000 B.C., shortly before the earliest Pleniglacial (phase A of Zagwijn). La Chaise has potential significance as the only site with an intense 'tundra' fauna of dominant reindeer, etc. The fauna of Pech de l'Azé 4–7 is dominated by red deer with reindeer rare—presumably an interstadial in the span 50–30,000 B.C. at the Mousterian-Leptolithic changeover. The le Moustier G and H faunas are dominated by bovids, and lack significant frequencies of reindeer; but reindeer is reported from le Moustier F and Couze, presumably dating to Bordes' Wurm I. Thus most M.A.T. occupation of the Perigord was associated with an environment lying south of the tundra belt, but probably only just. One might expect this northern forest fringe environment to have been farther north in the warm Brorup (leading to the population dispersion), and farther south during the intense cold of Pleniglacial times. The general lack of evidence for M.A.T. occupation in the Pleniglacial, and the preference for near sea-level altitude settlements suggests the hypothesis that the territory of the M.A.T.

at the time might have centred on the newly-formed coastal plain round the Bay of Biscay, and currently under 20–90 m. of water.

D.M.C.

Conclusions

As a result of the 1965 excavations, we conclude that the well-known rockshelters on the east edge of Oldbury Hill were not likely to have been occupied by Pleistocene man. Their present form may be very different from their Pleistocene form, and unless all trace of occupation was removed by erosion before the commencement of sedimentation, no cultural debris of Pleistocene man was left near them.

A highly-characteristic series of stone tools was found *in situ* both by Harrison and ourselves at point N on the map in Fig. 2. This lies at the tip of a spur jutting out north-eastwards from the hill and recognised on the map by the fact that the house of Oldbury Hatch is situated on it. Extensive quarrying has altered the configuration of the spur, but it was once capped by hard rock, of which some blocks are to be found at site N, and which was weathered by frost shattering to form the stony cultural layer of site N. We presume that a rock overhang existed at the end of the spur in Pleistocene times and that it afforded protection from the south-west and west and possibly the north as well. The site is a vantage point looking east towards the Medway valley.

The lithic assemblage from Oldbury N is typical of the Mousterian of Acheulian Tradition, and it is the richest Mousterian assemblage in Britain. By comparison with French sites, notably those of the Dordogne region, we may conclude that the occupation was less concentrated, perhaps only seasonal. Very little first-class data on the M.A.T. are available in print, but reasons are advanced for placing Oldbury in the middle of its development, and recognising an earlier 'Paxton' phase in Britain. There is no geological means of dating the Oldbury site, but it would seem most likely to belong to the Brorup interstadial or conceivably the succeeding interstadial. The M.A.T. is important as the culture tradition which affected Britain in last glacial times—other parallel traditions are not well evidenced here.

D.M.C. and A.J.C.

Acknowledgements

The excavations of 1965 were carried out on the lands of Mr. P. Game of Oldbury Farm and Mr. Harold of Oldbury Hatch. We are extremely grateful to both these gentlemen for their permission to excavate and for lending valuable assistance in addition. Most of the excavation was done by our students, both the Oxford Extramural Delegacy class at Sevenoaks and sixth-formers; and to all who helped on the excavation we wish to record our gratitude. Mr. Peter Connor in particular looked after the excavation for a short

while and did valuable research on the history of the site incorporated in this report.

The work was aided by a sum of money from the British Museum, which purchased the finds, all of which will be deposited in the Palaeolithic collections where the Harrison material is already stored. To Messrs. Bruce-Mitford, Brailsford and Sieveking and to all the staff of the British Museum who have facilitated and assisted our work on the museum collections, some of which is incorporated in this report, we express our sincerest thanks. During the excavation we were fortunate in having the advice of Mr. Peter Tester and Mr. John Wymer who are both familiar with the problems of the Kent Palaeolithic, and visited the site with us.

Our researches on the wider questions have been assisted by many authorities and curators, especially Prof. Bordes who generously allowed us to work on the very fine collections of the Laboratory of Bordeaux University; some of the metrical data is not hitherto published, as is also the case with two of Mr. Tester's assemblages. To all the authors of published works quoted here we are indebted; we have benefited from illuminating discussions with Messrs. Tester and Mellars and Prof. Bordes.

We are grateful to Mr. H. M. Stewart and Col. A. B. de Quincey for drawing the figures and to Dr. J. d'A. Waechter for reading the text.

ADDITIONAL REFERENCES

Bordes, F., and Fitte, P., 'L'Atelier Commont', *L'Anth.* 57 (1953), 1–45.

Harrison, B., Note in *Report of British Assoc.* Cardiff (1890), 357.

Mellars, P. A., 'The Chronology of the Mousterian Industries in the Perigord Region,' *P.P.S.* 35 1969 (1970), 134–71. (This paper appeared after this article was set up in type).

Sites with lithic assemblages	Layer	No. of Tools		TRENDS				ZONE and LINE FOSSILS as % of TM (9–38+42–3), types common in Moust.					
		Essen-tial	TM	I.L.	Hand-axe mean length in mms.	I.F.s.	I.Dih.	Racloirs 9–29	Knives 36–7	Cortex Knives 38	U.P. 30–7	types Notches 42	Dentic-ulates 43
Rochette	7	157	111	5	—	9	25	5	42	14	55	12	14
Pech de l'Azé	7	256	196	7	48	17	34	6	15	20	18	16	36
	6	212	158	8	49	15	34	7	12	25	16	18	35
	5	100	77	11	53	21	37	12	2	3	10	29	32
	4	2731	2152	8	58	37	21	38	2	4	10	22	27
	3	296	221	7	51	42	19	24	2	5	10	24	36
Chaise de	3	636		15	58	46	15						
Vouthon	4	755	508	15	64	47	13	38	3	4	8	14	38
grotte Suard	6	169		20	—	54	12						
Oldbury N		28	27	(15–23)	66	40	15	(63)	(0)	(4)	(10)	(23)	(4)
Fontmaure	lower	1595	1159	23	74	50	14	24	2	1	13	30	29
Moustier	H	?	1726	28	—	48	17	10	23	4	29	29	29
abri Peyrony	G	?	866	37	83	43	14	25	19	0	25	17	37
	F	?	209	39	—	68	8	12	8	1	27	23	38
Gare de Couze	upper	?		47	72	65	8						
	lower	327	257	56	88	60	8	45	6	0	22	6	19
Blanchard	lower	?		57	96	52	11						
Tillet	'cafe au lait'	71	62	68	103	56	17	47	8	5	10	16	16

Seriation-line data for sites of the Mousterian of Acheulian Tradition.

N.B.—The three assemblages from Chaise de Vouthon are included for comparison only and belong elsewhere according to some interpretations.

The Chamfered Pieces from Ksar Akil (Lebanon)

by M. H. NEWCOMER

Broadly speaking the term chamfered piece covers a range of types which are morphologically close to end-scrapers but technologically allied to burins. The first section of this paper comprises a brief review of the literature on these tools from various sites and the second is a more detailed technological and typological analysis of chamfered pieces from Ksar Akil. The types proposed are meant for Ksar Akil only and represent an attempt to strike a balance between over-subdivision and over-simplification, the usual extremes encountered when a new tool class is recorded. In my opinion the fate of chamfered pieces in the literature so far has been a tendency towards over-simplification, the novelty of the class itself (when it is rigidly defined!) being felt to be sufficient without further detailed analysis.

The term '*éclats et lames à chanfrein*' was first used to describe a group of upper palaeolithic tools by Haller.[1] For a series of pieces from Abou-Halka levels IV e and f he gave the following description: '*un éclat ou* (*une*) *lame épaisse, qui se termine en chanfrein par une facette sectionnant l'outil carrément ou légèrement de biais. Les angles formés par la facette terminale et les pans latéraux sont émoussés ou encochés par de petites retouches, alors que la partie médiane du biseau reste intacte.*'[2] Haller[3] thought that perhaps several pieces illustrated in Turville-Petre's el-Emireh report[4] were '*éclats et lames à chanfrein*'; however in Garrod's later report on el-Emireh she states that there are no '*éclats et lames à chanfrein*' and only one rough transverse burin.[5] At least two earlier publications however describe and illustrate tools corresponding to Haller's definition. The first is Vignard's report on the industry from Champ de Bagasse, near Nag-Hamadi (Egypt),[6] in which he mentions a new '*espèce de*

[1] Haller, J., 'Notes de préhistoire phénicienne. L'abri de Abou-Halka (Tripoli)', *Bulletin du Musée de Beyrouth*, VI, 1942–1943, 1–19.

[2] Haller, J., *op. cit.* p. 12; fig. 4, 1–6 and Pl. I, 1, 2, 3.

[3] Haller, J., *op. cit.* p. 13.

[4] Turville-Petre, F. 'Excavation of the Palaeolithic cave Mugharet-el-Emireh, 1925', in Turville-Petre, F. *et al.*: *Researches in Prehistoric Galilee* 1925–1926, British School of Archaeology in Jerusalem, 1927, 3–8: pl. V.

[5] Garrod, D. A. E., 'The Mugharet el-Emireh in Lower Galilee: Type-Station of the Emiran Industry', *Journal of the Royal Anthropological Institute of Great Britain and Ireland*, vol. 85, 1955, 141–162: p. 161.

[6] Vignard, E., 'Une station aurignacienne à Nag-Hamadi (Haute-Égypte), station du Champ de Bagasse', *Bulletin de l'Institut Français d'Archéologie Orientale*, t.18, 1920, 1–20.

burins' in which '*le coup de burin . . . a été frappé perpendiculairement au grand axe de la pièce, . . . il conserve quelquefois . . . une certaine obliquité, mais il épouse toujours la forme de la pièce et, s'incurvant, donne à l'outil la forme d'un grattoir sans retouches.*'[7] Some of these tools however[8] appear to be normal transverse burins in the accepted sense, and in two later publications[9,10] Vignard identifies those pieces from Champ de Bagasse and the lone inverse example from Menchia[11] with the true French transverse burins.[12,13]

In 1937, Crowfoot[14] wrote of a series of 'blade sections' from neolithic Jericho (layers IX-XII) which have 'a very shallow notch . . . on one corner . . . and a transverse facet (which) runs from this notch to the opposite edge of the blade'.[15] She believed them to be made by a sort of microburin technique, described by Octobon,[16] which involved notching the blade margin, putting this notch on a narrow anvil, and striking the opposite edge with a wooden bar. After examining a series of the pieces at the Institute of Archaeology, London, I am led to doubt whether they are tools or whether they even represent a uniformly applied technique. Perrot[17] has suggested that they may represent a method for shortening and narrowing blades for fitting them into the slots of a sickle haft. The lateral margins of some specimens do indeed show silica gloss, but many do not, and the technique was applied in one case to a core rejuvenation flake unsuitable for use in a sickle. Furthermore, while some facets run across the dorsal surface of the blade as in Crowfoot's illustration,[18] others go squarely over the top as in a transverse burin and still others run over the ventral surface only.

In 1950, McBurney[19] published a series of tools from the lower levels (4, 5 and 6) of Hagfet ed Dabba (Libya) which he called '*une forme spéciale*

[7] Vignard, E., *op. cit.* p. 8.

[8] Vignard, E., *op. cit.* pl. 8, nos. 8 and 9.

[9] Vignard, E., 'Station Aurignacienne du Champ de Bagasse à Nag-Hamadi (Haute-Égypte)', *Bulletin de la Société Préhistorique Française*, t.26, 1929, 299–306.

[10] Vignard, E., 'Menchia, une station aurignacienne dans le nord de la plaine de Kom-Ombo (Haute-Égypte).' *Congrès Préhistorique de France, compte rendu de la XIVe session, Strasbourg–Metz*, 1953, 634–653.

[11] Vignard, E., *op. cit.* fn. (10), fig. 2, no. 13.

[12] Vignard, E., *op. cit.* fn. (9), p. 300.

[13] Vignard, E., *op. cit.* fn. (10), p. 644.

[14] Crowfoot, J., 'Notes on the flint implements of Jericho 1936', *Liverpool Annals of Arch. and Anth.*, 24, 1937, 35–51.

[15] Crowfoot, J., *op. cit.*, p. 47.

[16] Octobon, E., 'Recherches sur la technique du 'coup du micro-burin', *Bulletin de la Société Préhistorique Française*, t.32, 1935, 582–585: p. 584 and p. 583 experiment no. 7.

[17] Perrot, J., *Préhistoire Palestinienne*. Supplément au Dictionnaire de la Bible, columns 286–446, Paris 1968: col. 396.

[18] Crowfoot, J., *op. cit.*, pl. 10.

[19] McBurney, C. B. M., 'La grotte de l'Hyène (Hagfa ed Dabba) gisement à lames de la Cyrénaique', *L'Anthropologie*, t.54, 1950, 201–213.

de burin transversal'.[20] According to him these were a new type, made '*par un coup donné sur un des bords retouchés*'[21] and he illustrates a series of spalls.[22]

In a subsequent publication[23] McBurney elaborated on these 'transverse burins' from Dabba, stating that they are 'generally made on a thick blade', nearly always struck from the left margin, and have 'an average angle of about 45° to the plane of the bulbar face of the blade'.[24] He also notes a 'fairly constant ratio of just under three squills (spalls) per burin' and that these spalls may take off as much as 1 cm. of the blade's end, although 2–3 mm. is more normal.[25]

In recording the presence of similar tools from the 'Dabban' levels at the Haua Fteah (Libya)[26] McBurney attempted to clear up the terminological and technological problems surrounding this tool group with dubious success. A possible misprint puts Vignard's first description at 1926 instead of 1920, Crowfoot did *not* use the term 'chamfered blade' (this is McBurney's own invention),[27] and Haller did *not* propose the term '*lame chamfrée*' (see above for Haller's term). McBurney here gives a novel possible method of manufacture, suggested by V. Chmielewski, that of inserting the blade into a tubular bone and rotating the blade to take off the transverse spall. He further states that 'it is certain that an ordinary free hand burin-blow will not work satisfactorily, if at all'. In view of these statements about manufacturing techniques (see below for criticism of his and Crowfoot's suggestions) and the fact that the Jericho examples are neolithic, the conclusion arrived at in his next paragraph hardly seems justified: 'Such a combination of technological and typological characteristics provides a valuable cultural indicator'.[28]

Chamfered pieces have also recently been reported in quantity from Layer B of Amud Cave (Israel)[29, 30] but unfortunately the accompanying drawings are sparsely shaded and difficult to interpret. Only one of the

[20] McBurney, C. B. M., *op. cit.*, p. 207 and fig. 5, nos. 2–9.

[21] McBurney, C. B. M., *op. cit.*, p. 207.

[22] McBurney, C. B. M., *op. cit.*, fig. 5 nos. 10–16.

[23] McBurney, C. B. M. and R. W. Hey, *Prehistory and Pleistocene Geology in Cyrenaican Libya*, Cambridge University Press, 1955.

[24] McBurney, C. B. M. and Hey, R. W., *op. cit.*, p. 202.

[25] McBurney, C. B. M. and Hey, R. W., *op. cit.*, p. 202.

[26] McBurney, C. B. M., *The Haua Fteah (Cyrenaica) and the Stone Age of the South-East Mediterranean*, Cambridge University Press, 1967: p. 143.

[27] The references to Crowfoot's article given in the Haua Fteah report are incorrect both in the text and the bibliography; see the present footnote 14 for correct year, volume and pages.

[28] McBurney, C. B. M., *op. cit.*, fn. (26) p. 143.

[29] Watanabe, H., 'Les 'éclats et lames à chanfrein' et la technique de fracturation transversale dans un horizon paléolithique en Palestine', *Bulletin de la Société Préhistorique Française*, t.61, 1964, LXXXIV-LXXXVIII.

[30] Watanabe, H., 'A Palaeolithic Industry from the Amud Cave, Israel. Preliminary Report', *Communications to VII Int. Congress of Anthropological and Ethnological Sciences*, Tokyo, 1965, 15–21.

illustrated tools could in my opinion be a true chamfered piece;[31] the rest appear to be broken pieces with the edges of the break retouched.[32] Watanabe defines them as 'fragments of flakes and blades with a retouch at a corner formed by the intersection of the transversally mutilated facet and the original edge of the flake'.[33] This is also difficult to interpret, but since in both articles he compares his material with the undoubted '*éclats et lames à chanfrein*' from Abou-Halka, the point is open to question.

Mrs. L. Copeland has kindly shown me an unpublished collection of 72 chamfered pieces from level V at Antelias Cave which, before destruction by quarrying, was located less than half a mile south of Ksar Akil on the right-hand branch of the Wadi Antelias. Mrs. Copeland is preparing a report on this collection and has pointed out to me the close similarity in method of manufacture and complexity of form of this Antelias V material to that of Ksar Akil.

A word about terminology would be appropriate before proceeding with definitions. The term 'chamfered' is a misnomer, since it is readily apparent from the drawings here and in other publications cited that none of these tools is chamfered in its usual sense of meaning a double bevel. Also, the French '*chanfrein*' has been used by Gobert[34] to mean burin facet and by Lwoff[35] to mean a kind of single bevelled edge preformed on the core. However, Haller,[36] Garrod,[37] Watanabe,[38] McBurney,[39] and Copeland and Waechter[40] have all employed 'chamfered' or '*chanfrein*' in reference to tools made by the method described below, and it would be unwise to add yet another new term to the literature. 'Chamfered piece' is used here as it is briefer than Haller's '*éclats et lames à chanfrein*' and more accurate than McBurney's 'chamfered blades' (the chamfer may of course be on a blade or a flake).

'Chamfered piece' is used in the following sense here: a flake or blade which shows evidence of the use of chamfer blow method (the distinction between

31 Watanabe, H., *op. cit.*, fn. (30), fig. 44 and the same piece in Watanabe, H., *op. cit.* fn. (29), fig. 2 top left-hand drawing.

32 See the comments of Lwoff preceding Watanabe's 1964 article, in *Bulletin de la Société Préhistorique Française*, t.61, 1964, p. LXXXII.

33 Watanabe, H., *op. cit.*, fn. (30), p. 20.

34 Gobert, E. G., 'Sur un rite capsien du rouge', *Bulletin de la Société des Sciences naturelles de Tunisie*, t.3, 1950, 18–23: p. 20.

35 Lwoff, S., 'Ciseaux à facettes et ciseau à chanfrein de la grotte de la Marche. Lussac-les-Châteaux (Vienne)', *Bulletin de la Société Préhistorique Française*, t.64, 1967, LXXIV-LXXVII: p. LXXVII and fig. 4, no. 31.

36 Haller, J., *op. cit.*

37 Garrod, D. A. E., *op. cit.*

38 Watanabe, H., *op. cit.*, fn. (29), fn. (30).

39 McBurney, C. B. M., *op. cit.*, fn. (26).

40 Copeland, L. and J. Waechter, 'The Stone Industries of Abri Bergy, Lebanon', *Bulletin of the Institute of Archaeology*, no. 7, 1968, 15–36.

'method' and 'technique' as outlined by Tixier[41] is followed here). 'Chamfer blow method' is a variation of the method for producing a burin on retouched truncation[42] involving two stages: one, the preparation of an abrupt retouched platform (lateral straight or concave, or distal concave) usually at the distal end of a blade or flake; and two, the production of a transverse or clearly oblique facet (the 'chamfer facet') which runs across the dorsal surface of the blade or flake, is slightly arced, sharp edged, and has a negative bulb of percussion adjacent to the retouched platform (fig. 1). It is possible that the tip to be removed by the chamfer blow was first retouched into a regular outline as indicated in figure 1. This regularisation I have found to serve the same function of guiding and lengthening the run of the spall as does the 'cresting' of the first blade on a blade core and the 'preforming' of a burin spall retouched in the same manner. Unfortunately there are no first spalls in the Ksar Akil material which might settle this point.

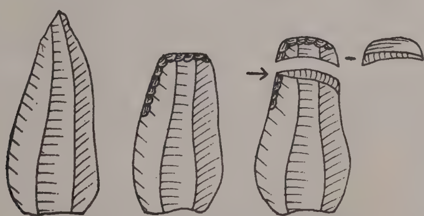

Figure 1 Method of manufacture

The main by-product of this method is the 'chamfer spall', which in its most easily recognised form consists of the distal tip of a blade or flake with the following characteristics: the remains of the retouched platform on one margin, a bulb of percussion adjacent to this platform, and an obtuse angle between the ventral surface of the spall and the original ventral surface of the blade or flake from which it was removed.

The chamfered pieces from the Boston College 1937–1938 excavations at Ksar Akil were studied at the Institute of Archaeology, London University, while working on a thesis on the burins from this site. These tools appear in quantity in only four levels; there are 27 in level 25, 55 in level 24, 263 in level 23, and 228 in level 22. Their importance as a tool group in these levels cannot be overstressed as they outnumber every other tool type in certain levels and

41 Tixier, J., 'Procédés d'analyse et questions de terminologie concernent l'étude des ensembles industriels du paléolithique récent et de l'épipaléolithique dans l'Afrique du nord-ouest'. In Bishop, W. W. and Clark, J. D., (eds): *Background to Evolution in Africa*, University of Chicago Press, 1967, 771–820: p. 813.

42 See Tixier, J., 'Typologie de l'Épipaléolithique du Maghreb', *Mémoire II du Centre de Recherches Anthropologiques Préhistoriques et Ethnographiques, Alger*, Paris, 1963: p. 27 and p. 28, fig. 2.

appear and disappear from the sequence rapidly.[43] There are one each from levels 30, 28a, 28b, and 26a of the 1947–1948 excavations[44] and only 7 from level 21, 5 from level 20, 2 from level 19, and 3 from level 17.

From such a large selection of chamfered pieces (total 590) one is able to derive a fair picture of the techniques used in their manufacture and re-sharpening. The method of manufacture described above was easy to deduce from a careful observation of undamaged specimens made on fine-grained raw material. So far as the actual techniques used are concerned, we may only make reasoned guesses based on working flint experimentally. The first stage of 'chamfer blow method', the preparation of the retouched platform, requires little comment. As with the preparation of a truncation on a burin,[45] a relatively wide retouched surface is more easily made with a hammerstone than a soft hammer. The blade or flake may be either hand held or rested on an anvil (*not* to produce '*retouche abrupte* "*sur enclume*" '[46] but simply to steady the work) although the irregularity of the retouch on Ksar Akil specimens indicates hand held work. The second stage, the blow itself, may, like the burin blow, be accomplished by several techniques all of which can yield good replicas of the chamfer facets as found at Ksar Akil. The first and most obvious is direct percussion with hammerstone, or soft hammer (which usually produces less crushing at the point of percussion than a hammerstone[47]). In order to take off a spall which goes over the dorsal surface instead of over the top as in a transverse burin, the blow should be angled upwards slightly from the ventral surface of the blade or flake. When blows go short as happened fairly frequently at Ksar Akil (and in my experiments) the offending hinge or step at the end of the facet may be retouched off, as may the false burin edge, to yield a smooth profile. Oddly enough the other extreme of badly executed blows, the plunging blow common in burin (and blade) manufacture does not seem to exist at Ksar Akil and I have not been able to produce a plunging chamfer spall experimentally. Probably the angling upwards of the blow and its transverse nature help explain this feature. A second technique is by swinging the prepared platform sharply against an anvil ('*percuteur dormant*' of Bordes[48]).

43 The cultural and chronological position of these levels as well as analysis of tools other than chamfered pieces, techniques of debitage, etc., will be found in the forthcoming report on Ksar Akil by Dr. J. Waechter (see Ewing, J. F., 'Preliminary Note on the Excavations at the Palaeolithic Site of Ksar Akil, Republic of Lebanon', *Antiquity*, vol. 21, 1947, 186–196; Ewing, J. F., *Ksar Akil in 1948*', *Biblica*, vol. 29, fasc. 3, 1948, 272–278; and Hooijer, D. A., 'The Fossil Vertebrates of Ksar Akil, a Palaeolithic Rock Shelter in the Lebanon', *Zoologische Verhandelingen*, no. 49, 1961, 4–67 for preliminary reports and correlation of depths with levels respectively).

44 Dr. J. Waechter personal communication 1969; I have not seen these levels.

45 Bordes, F., 'Étude comparative des différents techniques de taille du silex et des roches dures', *L'Anthropologie*, t.51, 1947, 1–29: p. 14.

46 Tixier, J., *op. cit.*, fn. (42), p. 47.

47 Bordes, F., *op. cit.*, p. 14.

48 Bordes, F., 'Typologie du Paléolithique ancien et moyen', *Publications de l'Institut de Préhistoire de l'Université de Bordeaux, Mémoire* no. 1, 1961: p. 13.

Pressure flaking is a third possible technique but I doubt whether any of the pieces from Ksar Akil were made this way as the negative bulbs of the chamfer facets are usually well marked and the rest of the industry shows no evidence of the technique.

Crowfoot's[49] idea of a laterally retouched notch being placed on an anvil and the opposite margin being struck with a wooden bar has not produced good results for me; the facets produced are straight rather than gently curved, the angle of the facet difficult to control, and a certain amount of crushing occurs on the ventral and dorsal surface of the blade where the soft hammer strikes, a feature not present on the Ksar Akil (or Jericho) chamfered pieces. In any case the Jericho pieces are not all made on notches. An anvil can be used with fair results however if the blade is turned so that the notch is facing upwards and the portion of the blade resting on the anvil is not directly under the notch but about 1 cm. back towards the blade's proximal end. Chmielewski's suggested technique[50] of putting the blade into a tubular bone and twisting was obviously devised with only parallel-sided blades in mind; it has not worked at all for me and it will be seen from the illustrated Ksar Akil material that one would be hard put to insert some of them into a bone, not to mention the problem of finding a different sized bone for different sized blades or flakes.

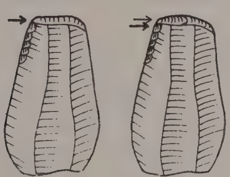

Figure 2 Method of resharpening (1)

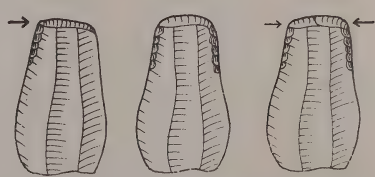

Figure 3 Method of resharpening (2)

Resharpening of chamfered pieces seems to have been carried out frequently. Three methods may be inferred: the first was by striking on the original retouched platform which often renewed only part of the edge (fig. 2). It is not always possible to say definitely whether this method has been used or whether, as is sometimes the case with burins,[51] the original blow has removed two spalls at once. The second was by making a new platform on the opposite margin and giving the chamfer blow, again renewing part of the edge only (fig. 3). The third involved lengthening the original or secondary platform (or striking lower on a platform made long perhaps with resharpening in mind) and removing the whole top of the piece (fig. 4). Sharpening spalls from the

[49] Crowfoot, J., *op. cit.*, p. 48.

[50] In McBurney, C. B. M., *op. cit.* fn. (26), p. 143.

[51] Tixier, J., 'Les burins de Noailles de l'abri André Ragout. Bois-du-Roc, Vilhonneur (Charente)', *Bulletin de la Société Préhistorique Française*, t.55, 1958, 628–644: p. 632.

first two methods would be extremely difficult to recognise. Of the lamentably small total of 8 spalls from this collection, 7 are the result of the third method of resharpening and carry an old facet on the distal end, the eighth having a truncation (fig. 8, nos. 13–18). Figure 8 number 13 shows the failure to produce a new chamfer edge using methods one and two, due perhaps to the visible flaw in the raw material.

Figure 4 Method of resharpening (3)

The function of these tools, like most other palaeolithic types, is unknown. An examination under a low-power binocular microscope (27x) revealed that the chamfer edge did consistently show damage, most commonly on the dorsal surface, in the form of a row of small irregular flake scars. The same sort of damage was duplicated experimentally by dragging the chamfer edge over a piece of wood or bone in one direction only, toward the worker. Pushing the tool produced edge damage on the ventral surface. Of course duplicating edge damage tells one little about the original use to which tools were put. Measurement of the angle between chamfer facet and ventral surface on 100 chamfered pieces (all types) gave 53° as the mean, while the mean angle between scraper front and ventral surface on 100 scrapers (all types) from levels 25 to 22 was 72°, suggestive of different functions. Acutely edged chamfered pieces produced experimentally proved effective as knives. Any systematic work on the problem of function was ruled out by the amount of fresh damage all edges had sustained either during excavation or in storage.

Typological subdivisions within the group of chamfered pieces are certainly possible to make with the Ksar Akil material. These must be based on the position and shape of the retouched platform and the direction of the chamfer blow. Although they are close to burins technologically no twofold subdivision into 'dihedral' and 'on retouched truncation' (as is common practice in recent burin classifications) is possible since all but 4 of the 590 chamfered pieces are made on a retouched platform. Two of these exceptions were made using a vertical burin facet for the chamfer blow platform (e.g. fig. 8, no. 10), the other two being made on an unmodified flat surface or 'natural' platform (e.g. fig. 8, no. 12). This has definite stylistic if not functional significance since my experiments have shown that it is as easy, if not easier, to produce the chamfer edge from a burin facet platform as from a retouched one.

The types of Ksar Akil chamfered pieces are the following:

1. *Chamfer on straight lateral retouched platform* (fig. 5, nos. 1, 2; fig. 6, nos. 1–16).

This is the simplest type, one of the lateral margins having an abrupt retouched platform, and a chamfer facet more or less at right angles to this retouch and the axis of the tool. Variations do occur, the most common being when the chamfer method is applied to a rounded flake rather than a parallel-sided blade; here the retouched platform may curve slightly around the corner of the flake following its original contour (fig. 5, no. 2; fig. 6, no. 10). A high percentage of type no. 1 (27%) has retouched platforms on both margins, indicating that resharpening had taken place at least once in the tool's life (fig. 6, nos. 2, 10, 12, 15). The reason for making a new platform on the opposite margin is uncertain, but my experiments suggest that continued resharpening attempts from one margin only, using the first sharpening method described above, eventually lead to hinge fractures from chamfer blows that do not carry all the way across the top of the piece (fig. 6, no. 16).

2. *Chamfer on lateral retouched notch* (fig. 5, no. 3; fig. 7, nos. 1–8).

On this type the platform for the chamfer blow is a retouched lateral notch which alters the outline of the piece. The chamfer facet is again more or less perpendicular to the axis of the piece. The use of a notch rather than straight lateral retouch may be related to the thickness of the margin of the blade or flake; when it is thick a little straight retouch will provide a suitable platform, when thinner, a notch encroaching into the thicker centre of the blade or flake solves the problem. A smaller percentage (15%) of this type shows the remains of a secondary platform on the opposite margin (fig. 7, no. 3).

3. *Oblique chamfer on distal retouched notch* (fig. 5, no. 4; fig. 7, nos. 9–16).

Type no. 3 has a more or less concave retouched platform placed at the end of the blade or flake, and a chamfer facet oblique to the axis of the tool. This type cannot be accounted for by technical contingencies, as type no. 2 may be. It is possible that the retouched platform formed part of the working edge of the tool; in some cases the sharp spur (false burin edge) between the chamfer facet and the platform has been retouched off, in other cases not.

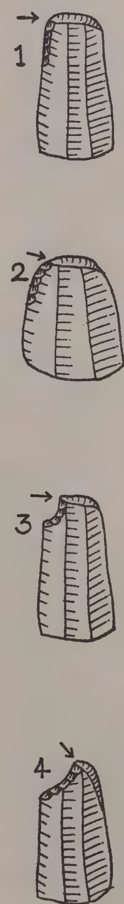

Figure 5, 1–4.

4. *Nosed chamfered piece* (fig. 5, no. 5; fig. 8, nos. 1–4).

Type no. 4 resembles a nosed scraper in outline. The chamfer facet is bounded by two retouched notches, one or (rarely) both serving as platforms for the chamfer blow. Variations of type no. 4 may have nearly straight retouched platforms.

5. *Multiple chamfered piece* (fig. 5, no. 6; fig. 8, nos. 5–7).

This type is rare but distinctive, two chamfered edges being associated on the same blade or flake, usually at opposite ends. This type is too rarely encountered in the Ksar Akil matriale to justify creating sub-types based on which of types 1–4 are associated.

6. *Composite chamfered piece* (fig. 5, no. 7; fig. 8, nos. 8, 9).

Type no. 6 is the composite tool, having either a scraper or a burin and a chamfer facet, again usually at opposite ends. The argument for keeping types 5 and 6 rather than breaking them down into their component parts has been clearly stated in a recent article by Bordes[52] and needs no further defence.

Figure 5, 5–7.

7. *Divers* (fig. 8, nos. 10–12).

The final category, *divers*[53] covers all pieces not referable to types 1–6. There are a few bizarre forms here (fig. 8, no. 11), some broken and damaged pieces impossible to assign to a type, as well as pieces which might be considered as transitional forms between burins and chamfered pieces, although it should be noted that transverse burins are not a type for these levels.

A fair number of pieces from Ksar Akil levels 25–22 show clear signs of having once been chamfered pieces but have since been transformed into various types of end-scrapers. Following Tixier,[54] these tools must show (1) that they have indeed been transformed and (2) that they have undoubted traces of having been chamfered pieces once. Since they are now end-scrapers they have not been included in this study. Only the two chamfered pieces made on burin facets can be considered as tools transformed into chamfered pieces.

[52] Bordes, F., 'Considérations sur la Typologie et les techniques dans le Paléolithique', *Quartar*, Bd. 18, 1967, 25–55: p. 35.

[53] See Bordes, F., *op. cit.*, fn. (48) p. 43; Tixier, J., *op. cit.*, fn. (42) p. 154 and p. 156; and Bordes, F., *op. cit.*, fn. (52) p. 35.

[54] Tixier, J. *op. cit.*, fn. (42) p. 156.

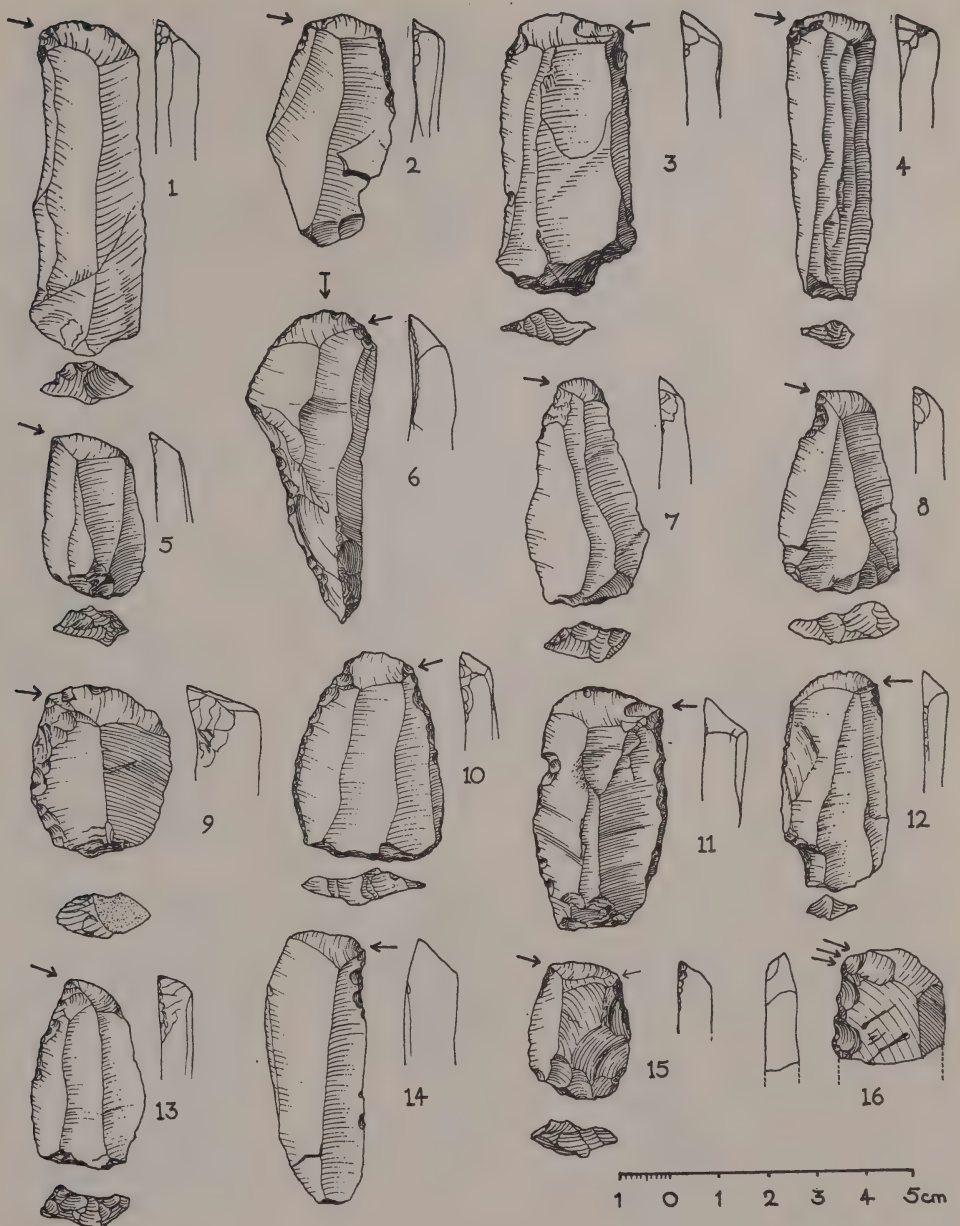

Figure 6 Numbers 1–16 type 1 (1,9 level 25; 2,11 level 24; 3,6,7,12,13,16 level 23; 4,5,8,10,14,15 level 22)

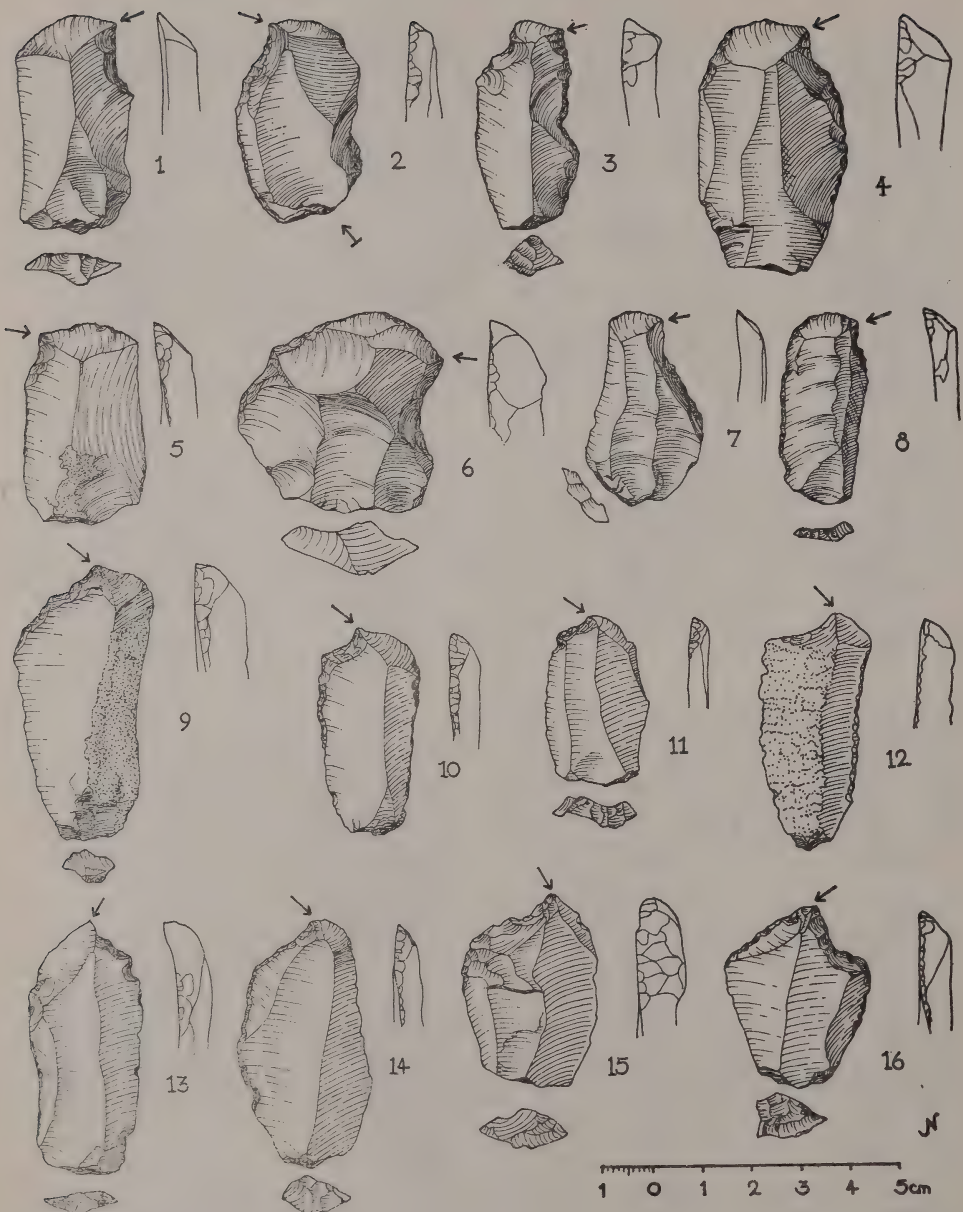

Figure 7 Numbers 1–8 type 2; numbers 9–16 type 3 (6 level 25; 15,16 level 24; 1,3,4,7,8,12 level 23; 2,5,9,10,11,13,14 level 22)

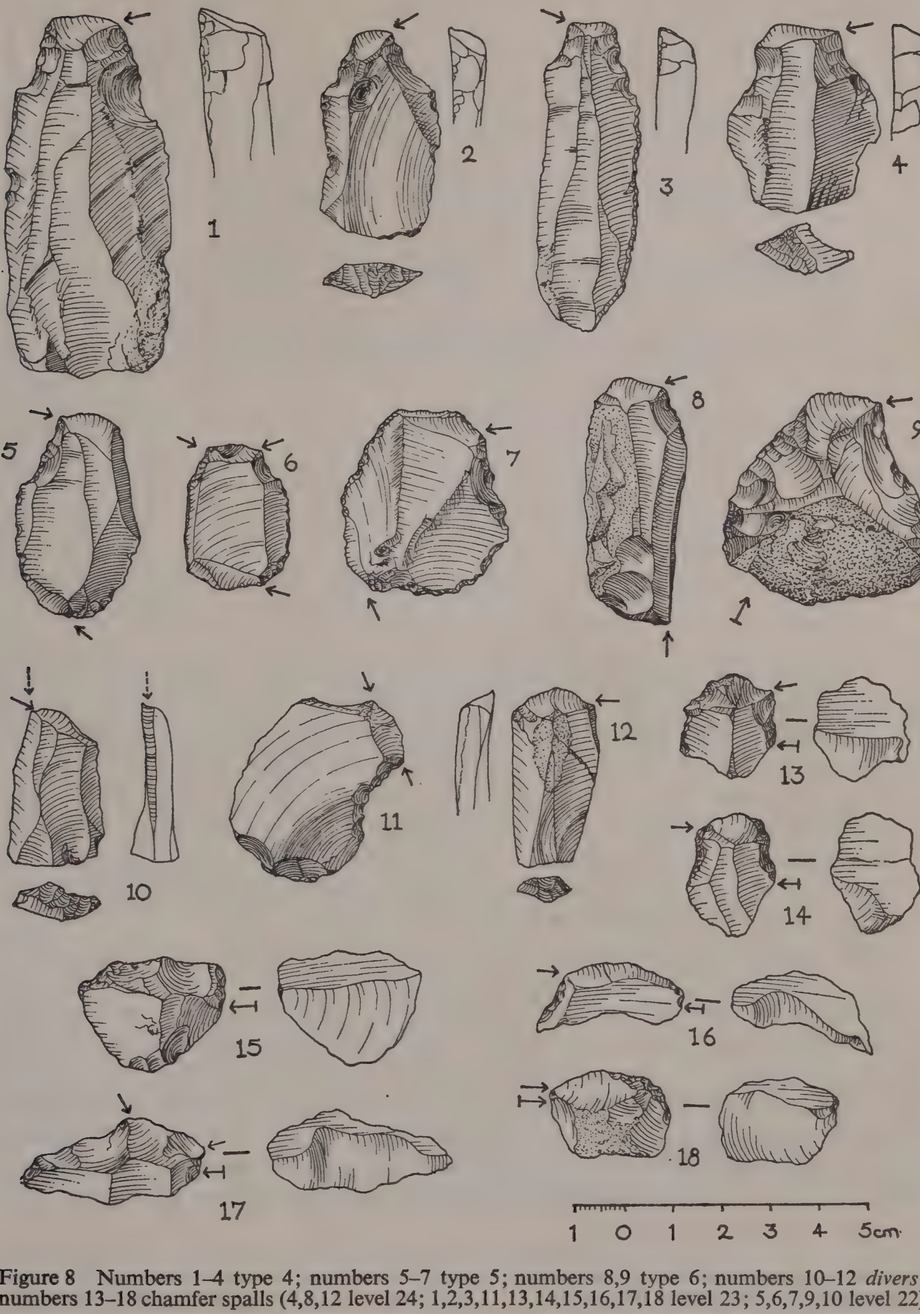

Figure 8 Numbers 1–4 type 4; numbers 5–7 type 5; numbers 8,9 type 6; numbers 10–12 *divers*; numbers 13–18 chamfer spalls (4,8,12 level 24; 1,2,3,11,13,14,15,16,17,18 level 23; 5,6,7,9,10 level 22)

	1	2	3	4	5	6	7	Total Chamfered Pieces	Total Tools
25	15 (55.6%)	3 (11.1%)	7 (25.9%)			1 (3.7%)	1 (3.7%)	27	70
24	28 (50.9%)	8 (14.5%)	7 (12.7%)	4 (7.3%)	2 (3.6%)	2 (3.6%)	4 (7.3%)	55	115
23	124 (47.1%)	46 (17.5%)	54 (20.5%)	18 (6.8%)	8 (3.0%)	4 (1.5%)	9 (3.4%)	263	537
22	108 (47.4%)	39 (17.1%)	44 (19.3%)	9 (3.9%)	15 (6.6%)	6 (2.6%)	7 (3.1%)	228	1,633
21	2		3	1			1	7	511
20	4	1						5	905
19	2							2	575
17	1	1	1					3	1,536
	284	98	116	32	25	13	22	590	

It will be seen from the table above that only levels 24, 23, and 22 have enough chamfered pieces to warrant presentation on a cumulative graph (fig. 9). The marked similarities between these three levels is obvious and any attempt to trace an 'evolution' of this tool group within these levels at Ksar Akil may be ruled out. Even level 25 with only 27 pieces seems to be part of the same general pattern. For the purposes of illustration then, the total of 590 pieces will be considered as a unit from which various examples of each type are drawn. The number of each type figured is roughly proportional to its frequency of occurrence in levels 24, 23, and 22.

The sudden appearance of chamfered pieces at level 25, and their virtual absence after level 22 will be made clearer when the report on the total tool assemblages appears. Since I have seen only a small amount of the material from Dabba, Haua Fteah and Jericho (and none from Amud, Abou-Halka, Champ de Bagasse or Menchia) this report is comparative in only a very limited sense and generalisations about possible relationships between assemblages containing chamfered pieces would be premature. At any rate it may be hoped that Garrod's speculation ('. . . it will be interesting to see if . . . (chamfered pieces occur) in the transitional layer of Ksar Akil')[55] has been answered.

[55] Garrod, D. A. E., *op. cit.* p. 161.

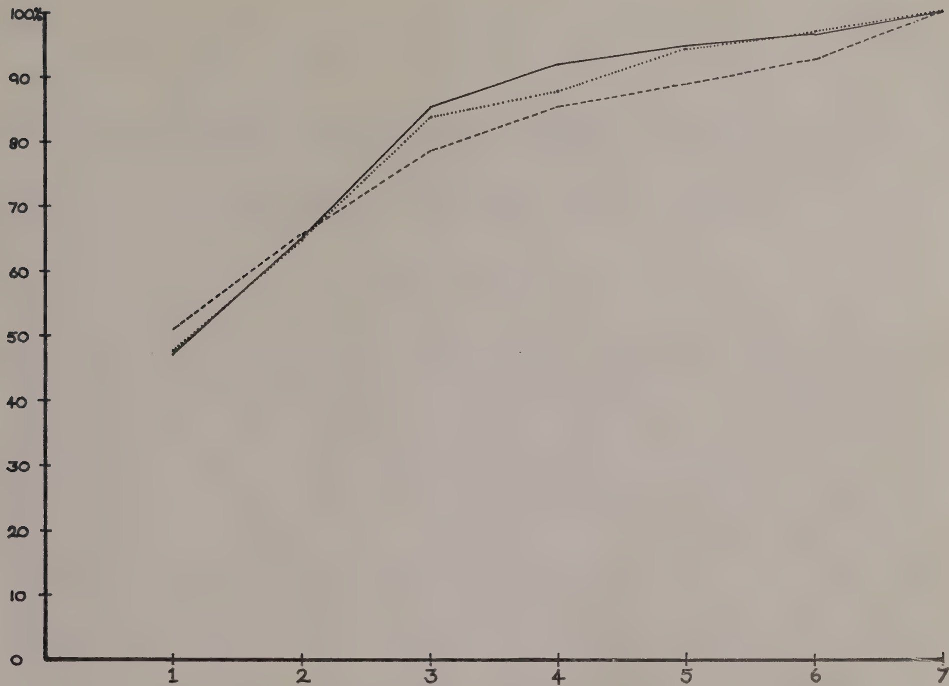

Figure 9 Cumulative graph showing distribution of 7 types of chamfered pieces in levels 24, 23, 22 (broken line level 24; solid line level 23; dotted line level 22)

Preliminary Survey in N.W. Arabia, 1968

by P. J. PARR, G. L. HARDING and J. E. DAYTON

INTRODUCTION

The archaeological reconnaissance of North West Saudi Arabia, which is the subject of this report, was carried out during a period of three weeks in the spring of 1968 by an expedition formed at the instigation of one of the present authors (J.E.D.) and sponsored by the University of London Institute of Archaeology. It was the first official archaeological expedition from this country ever to operate in Saudi Arabia, and it therefore forms something of a milestone in the history of British archaeology abroad. The expedition was financed largely from private sources, but partly also by grants from the Royal Geographical Society and the Palestine Exploration Fund. A permit for the work was granted by the Saudi Arabian Ministry of Education, through the Department of Antiquities in Riyadh, and the expedition's gratitude must be expressed to H. E. Shaikh Hassan Ibn Abdallah Al Shaikh (Minister of Education), to Mr. Mohammed Ibrahim (Director of Antiquities), and to Mr. Adil Ayyash (Archaeological Advisor to the Department of Antiquities) for their constant assistance, encouragement, and courtesy. The representative of the Saudi government was Mr. Abdullah Hadlak, curator of the Riyadh Museum, and the success of the expedition was in no small measure due to his enthusiasm and forebearance. The authors would also wish to acknowledge the help and advice given them by members of the British Embassy in Jedda (and in particular by Mr. W. Morris, H.B.M. Ambassador, and Mr. James Craig, Chargé d'Affairs); by Mr. R. W. H. Charlton, British Council representative in Riyadh; and (last but not least) by the Director of the Institute of Archaeology, who, apart from permitting the name of the Institute to be used in connection with the survey, has consented, at some inconvenience to himself, to publish this report in the *Bulletin* which he edits.

The area covered by the expedition's permit, comprising the districts historically known as Midian and the Northern Hejaz[1], extends some 350 kms. southwards from the Jordanian frontier at Aqaba and Muddowwerah to the

[1] For different views concerning the historical boundaries of this region, see H. Lammens, 'L'ancienne Frontière entre la Syrie et le Higaz', in *L'Arabie Occidentale avant l'Hégire* (1928), and A. Musil, *The Northern Hegaz* (1926), p. 255 ff.

latitude of al-Wajh on the Red Sea coast, and from that coast on the west to the line of the Tabuk–Tayma–Khaybar highway in the east, some 250 kms. inland (Fig. 1). Although only a very small corner of the Arabian Peninsula, this is an area roughly equivalent in size to that of the whole of Jordan, and it is thus obvious that in the short time at the disposal of the expedition—some of which was in any case lost because of bad weather and other unforeseen events—only a preliminary examination of the region could be attempted. In the event it was decided to concentrate attention only on those sites already known from the work of previous travellers, and to make collections of surface pottery from these sites in order to provide an initial sampling of material from the region. At the same time, it was hoped to collect any new epigraphic material which might be brought to the expedition's notice, and to re-copy a number of already recorded inscriptions, in order to check the accuracy and value of the work of previous collectors. In anticipation of the main report below, it may be said at once that these limited aims were most satisfactorily achieved, and it is already possible to make a more detailed assessment of the archaeology of the region than has hitherto been possible. This, indeed, is not to be wondered at, since any sort of accurate assessment has hitherto been impossible, owing to the fact that the region has been almost entirely neglected by archaeologists during the past fifty years or so, during precisely the period when modern techniques of archaeological exploration have been developing elsewhere in the Middle East. In fact, apart from the unpublished survey by Reed and Winnett[2] in 1962, covering part of the same area traversed by the present expedition, the only exploration in Midian and the Hejaz since the First World War of which there is a record and which can claim to have any archaeological importance, is that of the late H. St. J. Philby, whose book *The Land of Midian* (1957) gives a detailed and reliable account of the topography of the country, and was the present expedition's constant *vade mecum*. Philby's descriptions of such ancient sites as he knew of and visited (such as Mugha'ir Shu'ayb, Rawwafah, and Qurayyah) are also, so far as they go, accurate and useful, but unfortunately his photographs are poor[3], and he did not publish any plans or any of the surface sherds and other antiquities which he diligently collected during his journeyings[4]. Had he done so, much of the work of the present expedition would have been unnecessary.

[2] *B.A.S.O.R.* 168 (1962), pp. 9–10. Drs. Reed and Winnett also worked farther east, in the region of Hail in 1967; *cf. B.A.S.O.R.* 188 (1967), pp. 2–3. (Since these words were written Reed and Winnett have published the results of their 1962 expedition (University of Toronto Press, 1970))

[3] Sad to say, his hand copies of inscriptions and graffiti are even poorer, and completely unreliable. See below, p. 242.

[4] According to a letter from Philby to one of the present writers (P.J.P.) in 1959, this material was originally deposited by him, duly sorted and labelled, in a small museum in Jedda. It has now been removed to the new national museum in Riyadh, and it is to be hoped that it will one day be studied and published. There is reason to believe also that unpublished notes and illustrations of archaeological value exist amongst Philby's papers, and the writers are indebted to Miss Elizabeth Monroe, of St. Anthony's College, Oxford (who is writing a biography of Philby) for her help in trying to locate these.

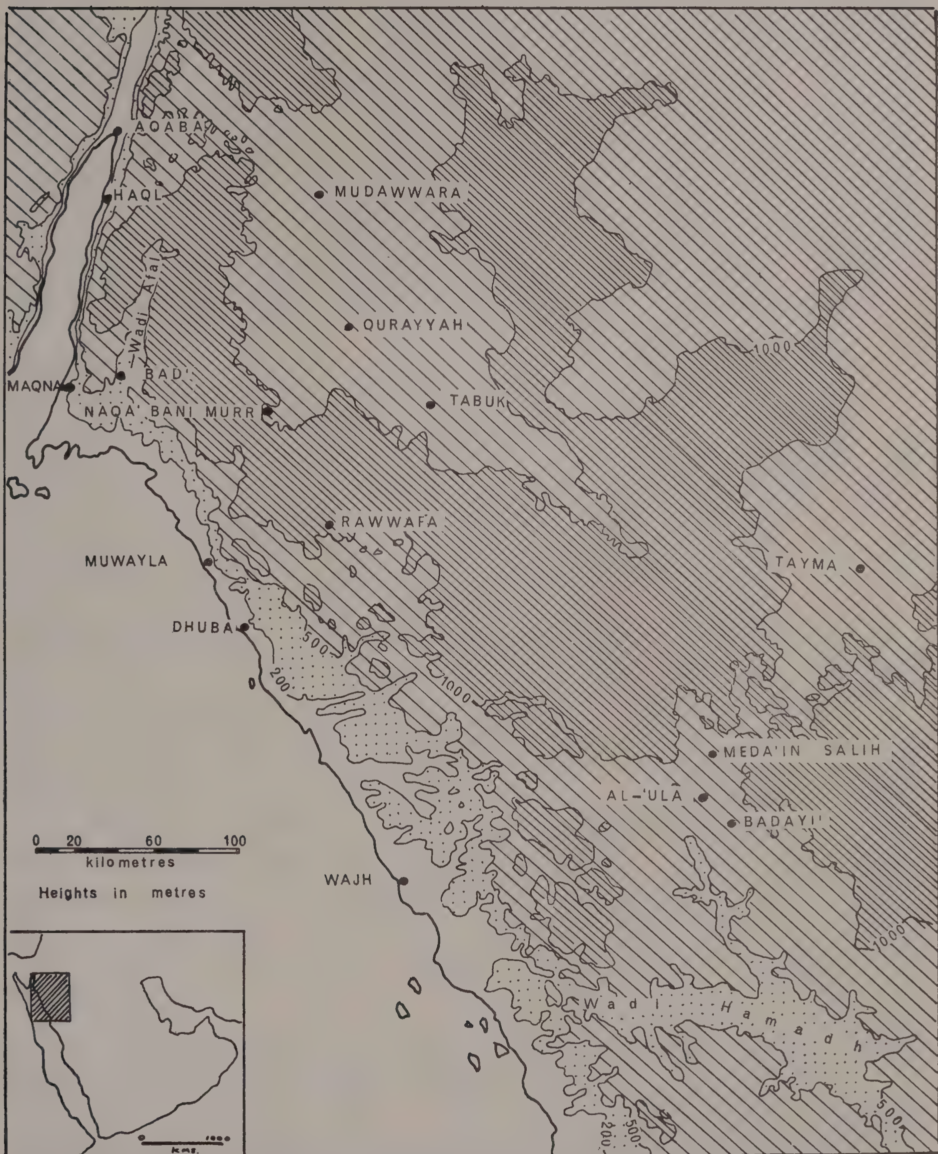

Figure 1 Map of N.W. Arabia

Prior to Philby's explorations, the region had received a certain amount of attention from travellers and orientalists during the nineteenth and very early twentieth centuries. The early history of this activity has been recounted by Hogarth in *The Penetration of Arabia* (1904), and includes such names as Burckhart (1812), Rüppell (1826), Moresby and Wellsted (1831), Wallin (1848), Burton (1877), Doughty (1877/8), Huber (1878 and 1883) and Euting (1883). The construction of the Hejaz Railway between 1904 and 1908 made the area more accessible, and the opportunity to investigate was taken by such scholars as Jaussen and Savignac (1907–10), Moritz (1910), and Musil (1910). The account left by Musil,[5] and especially the voluminous report of Jaussen and Savignac,[6] remain today the basic source books for the archaeology of the area, and the few works of synthesis which have been written more recently rely almost entirely upon them.[7]

GEOGRAPHY[8]

The effective northern boundary of the Midian–North Hejaz region lies some distance north of the present political frontier, on a line between Naqb Ishtar and Batn al-Ghul in southern Jordan, where a steep and dramatic escarpment terminates the Jordanian plateau. North of this escarpment—the 'brow of Syria', as the Arab geographers called it—the horizontal limestone beds of the plateau lie undisturbed; south of it they are worn away to reveal a more ancient landscape of sandstones and crystalline rocks. A number of more or less clearly defined morphological zones can here be detected, all lying roughly parallel to the coastline of the Aqaba Gulf and the Red Sea.

The most dominant of these is the up-tilted western edge of the Arabian massif itself, just beginning to appear along the eastern edge of the Arabah rift valley north of Aqaba, but farther south, along the Gulf and the Red Sea, forming a most imposing range of granite and schist peaks. Immediately east of the Gulf these rise almost sheer from the coast, and reach their highest point in Jabal al-Lawz (2580 m.); farther south there is a narrow coastal strip, and the mountains are on the whole a little lower (Jabal Dibbagh, inland from Muwailah, 2350 m.). A number of wadis cut down from the crest of the range to the coast; generally speaking they are too tortuous and precipitous in their upper reaches to provide good routes across the range, but where they emerge

[5] A. Musil, *The Northern Hegaz* (1926).

[6] Jaussen and Savignac, *Mission Archéologique en Arabie*, I (1909), II (1914), text and plates.

[7] For example, that of A. Grohmann, *Kulturgeschichte des Alten Orients: Arabien* (1963) pp. 38–89. See also the same author's synthesis in McGraw-Hill's *Encyclopedia of World Art*, Vol. I (1959), columns 514–562.

[8] The best geographical description of the area is still that in the Admiralty *Handbook to Western Arabia and the Red Sea* (1946). The most up-to-date and reliable maps are those prepared by the U.S. Geological Survey and the Arabian-American Oil Company (ARAMCO) for the Saudi Arabian Government, the topographical sheets relevant to our area being 1.200 B and 1.204 B, published in 1962 and 1959 respectively. The system of transliteration used for these maps has been adopted in the present report, with one or two exceptions.

into the narrow coastal plain they often broaden out to form relatively fertile and easy country, and serve as some sort of agricultural hinterland for the series of small harbours which line this sector of the Red Sea (e.g. Muwailah, Dhuba, al-Wajh). In the north, the wadi Afal, running parallel to the Gulf of Aqaba, provides the only practicable route through the mountain chain. Along the coast, the explorations of Burton have revealed the existence of a number of important ruins, and although this area was not visited by the present expedition, it is undoubtedly one of the most promising parts of the whole area from an archaeological point of view, and will be investigated in future seasons of work.

Inland from the coastal range, where the crystalline shield dips down eastward beneath overlying Cambrian deposits, there appears a lower—but still elevated—area of sandstone mountains, often weathered into strange shapes, interspersed with great stretches of detrital sands. This area, known as al-Hisma, is the continuation into Saudi Arabia of the Wadi Rumm region of southern Jordan, and its fantastic scenery will be familiar to visitors to that country. Its northern part, east of the Gulf of Aqaba is barren and seemingly devoid of important ancient sites (the main exception being Rawwafah, below, p. 215), although the presence of Neolithic sites in the Wadi Rumm[9], suggests that similar early settlements may also await discovery south of the Saudi frontier. The southern part of al-Hisma, where run-off water from the western mountains is more easily retained in the shallower, broader valleys, often containing extensive deposits of clayey alluvium, is more favourable to settlement, and there are important oases at, for example, Meda'in Salih and al-'Ula. Large tracts of this southern part are covered with lava flows (*harra*), the product of volcanic activity which is known to have occurred on a considerable scale as late as the Middle Ages. While providing an impediment to communications, these lava fields weather into a fertile soil which, when well watered (as in the oasis of Khaybar), can support prosperous agricultural settlements.

In the latitude of Meda'in Salih and al-'Ula, at the southern end of the area of the present survey, the sandstone uplands and *harras* of which we have spoken level off towards the east to become a more open sandstone steppe, and this in its turn merges east of Tayma into the Great Nafud, or sand desert, which forms the boundary of the Hejaz in this direction. In the north, however, there is an important sub-region, al-Muhtatab, separating the Hisma from the steppe. This is an inland drainage basin, collecting run-off water from the western mountains, and provided with many wells, the most copious of which supply water for the main settlement, Tabuk.

The lines of communication through the Hejaz and Midian are, naturally, dictated by the geographical features which we have briefly described. The main route runs longitudinally along the eastern side of the Hisma and through the Tabuk basin, linking the conveniently spaced oases which occur there—al-'Ula,

[9] *Cf.* Sir A. S. Kirkbride and Lankester Harding, *P.E.Q.* 1947, pp. 7–26.

Meda'in Salih, Mu'azzam, Tabuk—and avoiding the crystalline peaks and *harras* on the one hand, and the Nafud desert on the other. This route is the ancient Incense Road from South Arabia to Syria, dating back at least to the time of Solomon and the Queen of Sheba, and very probably to a much earlier period. It is also the Pilgrim Road (the Darb al-Hajj) from Damascus to Medina and Mecca, and the line of the short-lived Hejaz Railway. The modern asphalt road takes a more easterly course, from Medina through Khaybar and Tayma to Tabuk, by-passing (as motorized traffic is able to do) some of the smaller wells; but it is essentially the same route. The only other north–south route is along the coast, but this is difficult on account of the many torrent beds it must cross, and is thus of only local importance, linking the anchorages, though it has in the past served in part to carry the pilgrim traffic from Egypt to Mecca, and is now being rebuilt. Of cross routes there are few formal ones, though perhaps further exploration will discover more informal ones, bedouin camel tracks which may have had an importance in antiquity out of all proportion to the marks they have left on the ground. One important transverse route links Haql and Maqna on the Gulf of Aqaba with Tabuk; another provides access from al-'Ula due west to the sea at al-Wajh; while a third—the most important—leads in a more southerly direction from the same port towards Medina, along the Wadi Hamdh, the longest and broadest valley in the whole of western Arabia, and potentially the richest archaeologically. Finally, there are the inland routes, from the Hejaz eastwards into the interior of Arabia. These are not frequent or well defined, but neither are they insignificant. A cluster of oases at the northern end of the Nafud, around Jawf, Sakakah and Shaqiq, determine the presence of a route to Iraq at this point, while from the same oases the great inland depression of the Wadi Sirhan, running north for several hundred kilometres, provides another route to Syria, an alternative to the Darb al-Hajj. Farther south, eastwards from Tayma, a route leads to the important towns of Hail, Anaiza and Buraida in the centre of the Peninsula, and ultimately to southern Mesopotamia and the Persian Gulf. The historical importance of these eastern routes is very great, for they mark the doorways through which the influence of more advanced ports of the Middle East, especially Mesopotamia, could have penetrated to the Hejaz.

THE SURVEY

Part I: Archaeology

The account which follows of the various sites visited during the survey is intentionally somewhat uneven. For some sites, such as al-'Ula, which has already been described in detail by previous investigators, only a little additional information is given; others, such as Rawwafah, are dealt with more definitively. Finally, for a number of sites, including the important settlement at Qurayyah,

no more than a summary of the recorded information is presented, since it is intended to return to these sites and make more extensive surveys. The report is kept as factual as possible, and no extended discussion of the discoveries is attempted at this stage. In the present volume of the *Bulletin* the archaeology of four of the more important sites visited will be discussed, while a number of other sites will be dealt with in a later issue. The epigraphic material will form the content of Part II of this report, also to be published in a later volume of the *Bulletin*, and only a brief introductory note (by G.L.H.) is included here (p. 242).

Ma'abiyat

About 18 kms. south-east of al-'Ula and 4 kms. west of the railway line at al-Badayi' station lies the extensive ruined Islamic site of Ma'abiyat. These are undoubtedly the ruins of which Doughty and Jaussen and Savignac were informed while they were at al-'Ula, but which none of them was able to visit.[10] There appears to be no other mention of them in the western literature, although their existence is well known to the Saudi authorities. The Wadi al-'Ula, the main north–south route here, followed by the Darb al-Hajj and the railway, begins to broaden out at this point, and is joined by several other wadis, along one of which, to the west, goes the modern track from al-'Ula to al-Wajh on the Red Sea coast. The region forms a low-lying basin of sandy and clayey soil, retentive of moisture and, with proper care, obviously as fertile as the al-'Ula oasis itself a little farther north. It is cultivated to a certain extent today, although the presence of a salt crust over much of the surface of the land suggests that drainage is neglected, with a resultant loss of fertility.

The ruins comprise two distinct parts (Fig. 2). To the south is an area of low mounds (Ruins A), probably partly natural, extending over an irregular area of some 350 x 250 m. The highest points of the mounds—the maximum being about 4.50 m.—fall generally speaking along the perimeter of this area, and it is these peripheral mounds which are covered with a liberal spread of sherds, plaster fragments, and a few baked bricks, suggesting that the original plan of the site was that of a series of structures surrounding an open central space.

About 700 m. north-west of Ruins A is a much larger and imposing area (Ruins B). This has a total extent of about 800 x 800 m.; it is irregular in outline, and its plan may best be seen by reference to the accompanying sketch (Fig. 2), which, it should be stressed, is based on rapid and approximate observations, and is in no way definitive. The south-western half of the site is very low and amorphous. On the other side, however, the line of the town wall is clearly visible, in the form of an embankment 3 to 4 m. in height (Plate 1), following

[10] C. M. Doughty, *Travels in Arabia Deserta* (1924 ed.), p. 161; Jaussen and Savignac, *op. cit.*, vol. II. p. 26.

a curiously angular and indented course, quite unrelated to the flat terrain.[11] At one point a stretch of the actual wall is preserved; this is of unbaked mud brick (the average size of the bricks being about 25 x 20 x 10 cms.) and stands

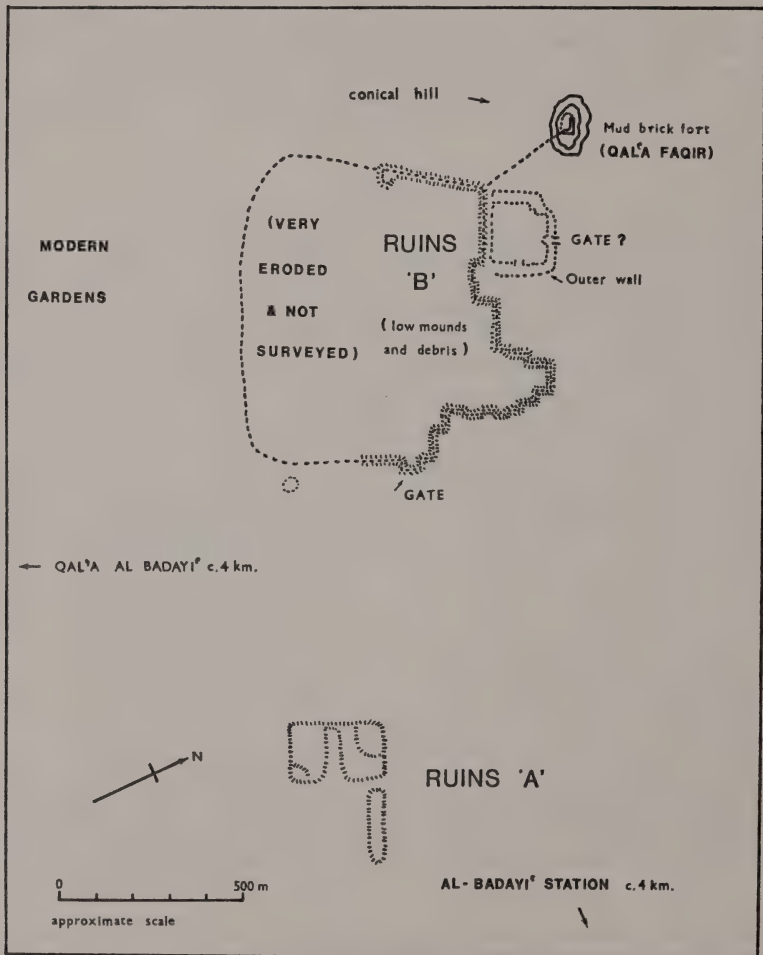

Figure 2 Ma'abiyat. General Plan

5 m. high (Plate 2). From the north-west corner of the site another wall runs for about 200 m. towards an isolated conical hill which dominates the site from

[11] A close—and surely fortuitous—parallel to this curious plan is afforded by the town wall of Pate, on the East African coast, dated by Chittick to the late eighteenth century (N. Chittick, *Azania* II (1967), pp. 58–60 and fig. 11).

this direction; the wall runs up the steep slope of the hill, and connects with the ruins of a mud-brick structure on its summit, known locally as Qal'a Faqir (a name which probably relates to the local tribe of that name), from which a good overall view of the site is obtained (Plate 3).

The surface of Ruins B is littered with fragments of pottery, glass and baked bricks of the same types as those found at the more southern site, and the material can be discussed together. Three fragments of glazed pottery were found (Fig. 3). Numbers 1 and 2 have alkaline glazes, and are probably of the eleventh or twelfth century, but number 3, with a lead glaze and decoration in manganese and copper, could be two or three centuries earlier.[12] Of the unglazed wares—all wheel made—the most characteristic were sherds of bowls with heavy, inturned rims, decorated with incised lines, straight and wavy. The bowls were generally in a hard gritty red or pink ware, often with a greenish surface. Analogies are to be found at a number of sites farther north, in Jordan. At Khirbat al-Mafjar vessels of Baramki's Ware 13 exhibit the same forms and style of decoration, and often have a greenish-grey slip, though the ware itself is described as being soft.[13] Baramki dates these bowls to the twelfth and thirteenth centuries A.D., but the evidence is perhaps not altogether reliable, and a considerably earlier date is suggested by the presence of somewhat similar pottery at Amman and Mt. Nebo. At Amman, material from the floor of an Ummayad house included large basins with thick profiled rims and combed decoration,[14] while the pottery from the basilica and monastery at Mt. Nebo, with an approximate range of dates between the fifth and eighth centuries, includes many similar incised bowls.[15] A few of the other Ma'abiyat sherds would also seem to be of an early Islamic date: 5 is reminiscent of Baramki's Ware 10 ('hard metallic ware'), assigned to the eighth century, while 13, with its deeply-cut design, has a parallel in eighth-century Mafjar also.[16] Moreover, two fragmentary steatite bowls from Ma'abiyat (Fig 3; 19 and 20) are also most probably of early Islamic, or even Byzantine, date; analogies are to be found in the material from Amman and Nebo already cited.[17] It should, however, be stressed that nothing certainly identifiable as Byzantine was found at Ma'abiyat, and that there were no examples of the ribbed wares which, farther north (as at Nebo) seem to have continued in popularity into the Islamic period. There remains, none the less, a strong possibility that Ma'abiyat is an Ummayad foundation, and it is clearly an important medieval site. Doughty reported that

[12] These dates are tentative only, since the sherds have not been examined by a specialist in Islamic ceramics. We are indebted to Mr. Henry Hodges, of the Institute of Archaeology, for studying photographs and drawings of the sherds, and helping with their description and identification.

[13] D. Baramki, 'The Pottery from Kh. al-Mafjar', in *Q.D.A.P.* X (1942), fig. 10, nos. 2 and 6.

[14] G. Lankester Harding, *A.D.A.J.* I (1951), fig. 2, nos. 48, 53 and 57; fig. 3, no. 50; and plate III.

[15] S. Saller, *Memorial of Moses on Mt. Nebo* (1941), plate 152, etc. Unfortunately, the volume on the Mt. Nebo pottery by H. Schneider is not available to the present writers in London.

[16] Baramki, *op. cit.*, fig. 4, no. 7.

[17] Harding, *op. cit.*, plate II, nos. 17–19; Saller, *op. cit.*, pp. 300–302, and fig. 34.

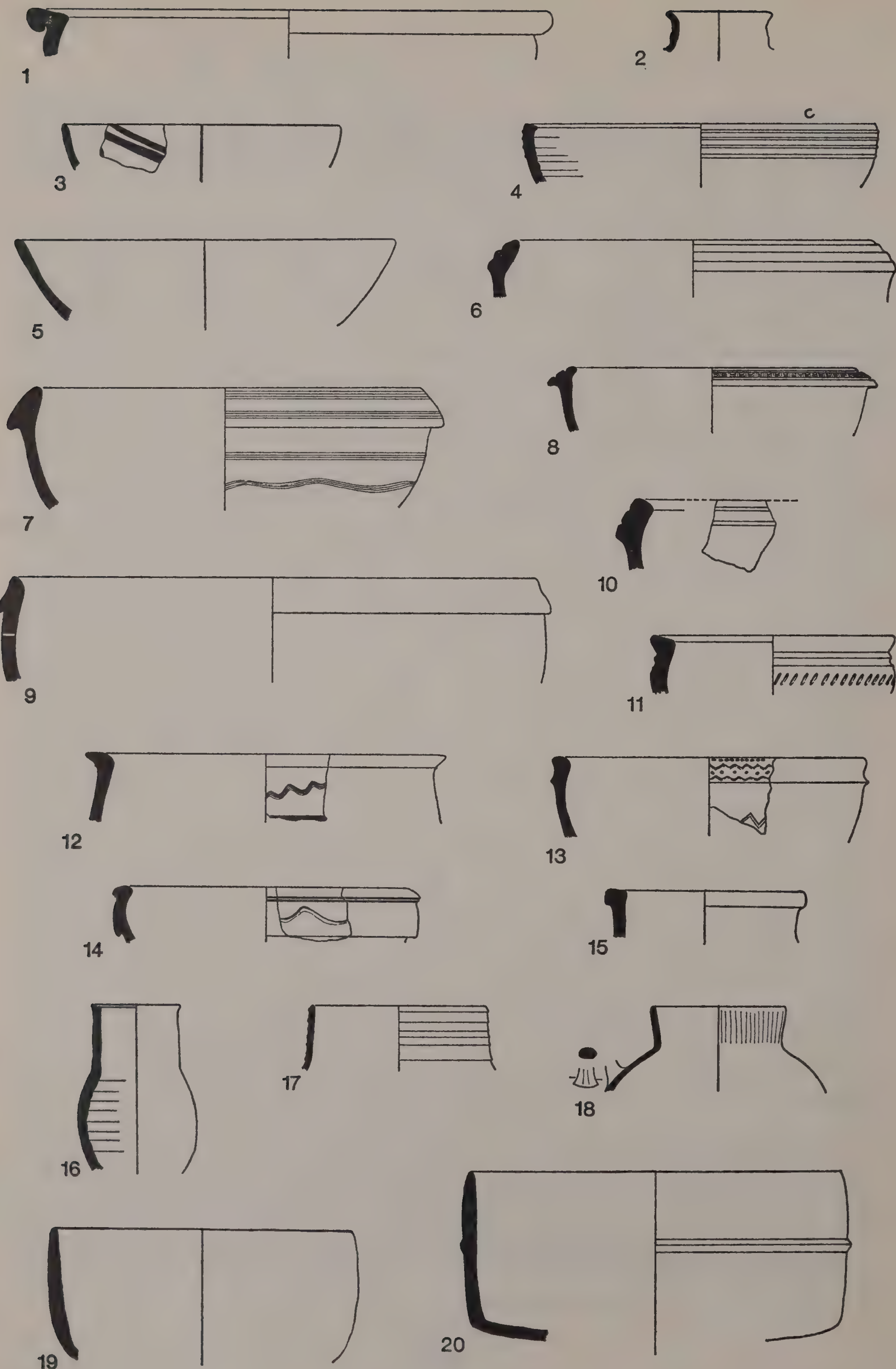
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Figure 3 Ma'abiyat. Pottery, etc. (Scale 1:5)

	Description	*Reg. No.*
1	Very hard fawn stoneware. Bright blue glaze all over.	M.5
2	Yellow buff ware, green-blue glaze all over.	M.32
3	Very fine hard pink-buff ware, olive green glaze on rim outside, all over inside, with patchy decoration in darker glaze.	M.6
4	Very hard dull red ware, sandy. Darker plum red slip outside.	M.12
5	Hard metallic red ware, fired throughout. Wet-smoothed or thin red slip.	M.1
6	Hard gritty red ware. Darker red wash inside. Outside discoloured.	M.8
7	Hard fine grey ware, fired red. Light green slip outside and probably originally inside.	M.11
8	Hard very fine pinkish ware, well fired throughout. Cream slip inside and out.	M.4
9	Very hard fine pinkish ware. Cream slip or wash inside, yellowish slip outside, somewhat sandy to touch.	M.3
10	Hard pinkish gritty ware. Pink surface inside. Traces of pale green slip outside.	M.28
11	Hard grey ware, firing to dull purple. Some fine grits. Mottled greenish and light brown outer surface, sandy to touch. Fawn inside surface.	M.16
12	Greenish buff ware, softish. Very pale green surfaces, sandy to touch.	M.25
13	Hard grey ware. Light green slip inside, slightly darker outside. Rough surface.	M.31
14	Hard grey ware, fired brick red.	M.22
15	Very hard deep red ware, lighter red slip or wash all over.	M.29
16	Hard grey ware, light green slip outside, buff inside. Sandy to touch.	M.13
17	Hard thin red ware, some largish grits. Well fired. Dark red slip outside.	M.7
18	Very fine sandy buff-brown ware. Light green slip outside. Very worn.	M.15
19	Steatite.	M.36
20	Steatite.	M.19

gold coins with Kufic inscriptions had been picked up there,[18] and repeats the Arab tradition that 'seven were the ancient townships of this country: Teyma, el-Hejr, Mubbia(t), Umgassur, Kheybar, el-Khreyby, Mogeyra'.[19] Tayma, al-Hijr, and Khaybar are all well-known sites; Umgassar is unknown; and Mogeyra is (according to Doughty) a little farther south from Badayi' on the Hajj road. If Mubbiat is our Ma'abiyat, then it is clearly a site which would repay further intensive investigation.

Some 4 kms. south-west of Ma'abiyat there is another qal'a, Qal'at al-Badayi', in a much better state of preservation than the Qal'a Faqir already mentioned (Plate 5). This is one of a series of such fortified posts guarding the Pilgrim Road to Mecca, each provided with a well or cistern; although most of them are known from the general descriptions left by such travellers as Doughty, Musil, and Jaussen and Savignac, they have not been studied in the detail they deserve. Some of them are dated by inscriptions; of those in Saudi Arabia which have been visited, Qal'a Dhat al-Hajj is dated to A.D. 1554, Qal'at al-Akhdar to 1531, and Qal'at al-Mu'zzam to 1622. Qal'at al-Badayi' has no inscription, but it resembles in plan the fort at al-Mu'azzam, especially in possessing circular corner towers, which (so far as the present writers are aware) do not occur in any other of these forts. The mode of construction of the

[18] *Op. cit.*, p. 161.

[19] *Ibid*, pp. 551–552.

Badayi' fort is distinctive. The masonry consists of medium-sized untrimmed blocks of sandstone, roughly coursed with the aid of small packing stones, and liberally interlaced with courses of flat baked bricks which often, especially in the upper parts of the structure and at the corners, replace the stonework entirely. These bricks are of exactly the same dimensions (approximately 22 x 10 x 4.5 cms.) and appearance as those which lie on the surface of the Ma'abiyat ruins, though they are quite different from the unbaked bricks in the wall of Ruins B. The faces of the walls of the qal'a, both inside and outside, are covered with a plaster coating, and the finished appearance is (again, so far as the authors are aware) unlike that of any other fort on the Darb al-Hajj. It is surprisingly reminiscent of the masonry of Qasr Kharaneh, in East Jordan, which, however, does not include brickwork; Qasr Kharaneh was built not later than A.D. 711, however, and the resemblance must surely be coincidental. The existence of identical bricks in the structure of Qal'at al-Badayi' and in the neighbouring ruins might conceivably suggest that the fort and the town are to some extent contemporary, but it is much more likely that the qal'a is later, being built with material partly derived from the ruins of the town site. Only further investigation can throw light on the problems raised by this most important site.

Al-'Ula (*Khuraybah*)

The identification of the ruins of Khuraybah, at the northern end of the al-'Ula oasis, with ancient Dedan was first proposed by Glaser in 1890, and is now universally accepted. The history of Dedan has recently been reviewed independently by Gaskel,[20] Albright,[21] and Ansari,[22] and need not be rehearsed here; it is enough to note that its importance as a trading centre as early as the sixth century B.C. is proved by epigraphic evidence, while Biblical references suggest that it was already in existence at the beginning of the first millennium. Its rôle was dictated by geography, for this is one of the principal oases in north and western Arabia, in that relatively fertile district known to the medieval Arab historians as the Wadi al-Qura (the Valley of Villages), and at a point where the caravan route between South Arabia and Syria is confined to a narrow pass through forbidding sandstone mountains and *harras* (Plate 6). This pass is today occupied by the modern settlement of al-'Ula, straggling for some 10 kms. along the derelict railway, between sheer cliffs of red sandstone, often 200 m. high. Like its predecessor, Dedan, al-'Ula is the commercial and administrative centre of a large district, relatively luxuriant and prosperous, with a plentiful supply of water, petrol, and local and imported foodstuffs.

[20] W. Gaskel, *Lihyan und Lihyanisch* (1954).

[21] W. F. Albright, 'Dedan', in *Geschichte und Altes Testament* (*Alt Festschrift*) (1953).

[22] In an unpublished Ph.D. thesis of the University of Leeds, 1966.

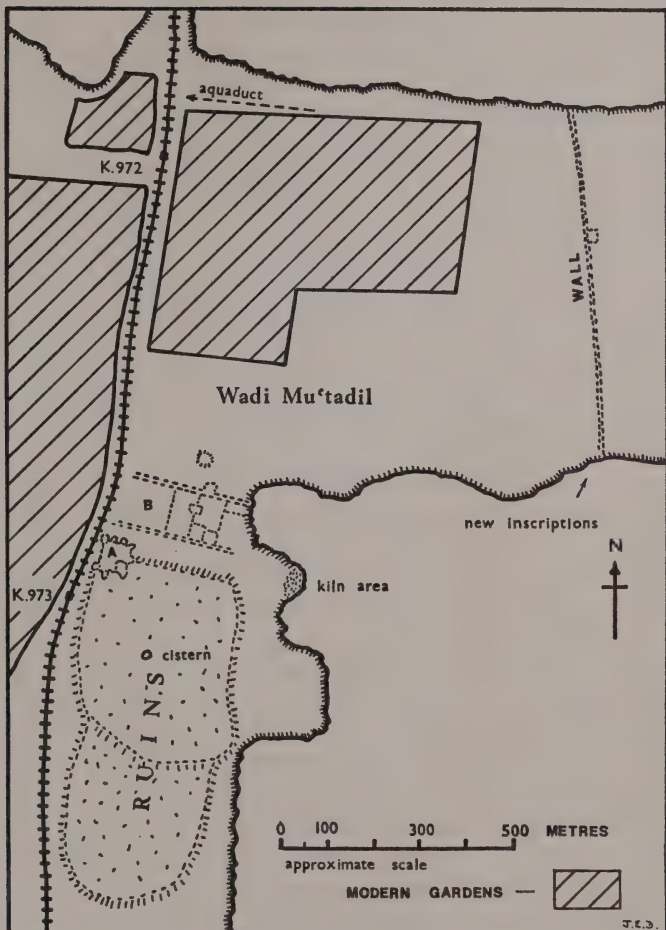

Figure 4 Khuraybah. General Plan

Al-'Ula has been visited by a number of western travellers, and its ancient remains have received a full and detailed study at the hands of Jaussen and Savignac.[23] These remains comprise three elements: (i) a necropolis of rock-cut tombs (including the famous Lion Tomb) in the cliffs on the eastern side of the valley, to the north of the modern town; (ii) numerous funerary texts and graffiti (Minaean, Lihyanite, Thamudic and a few Nabataean) mostly associated with the tombs, but found also farther afield throughout the valley; and (iii) the ruin-field (or *khirbah*) itself, situated at the foot of the cliffs below the necropolis.[24] Jaussen and Savignac devoted most of their time (two weeks in 1910) to a study of the tombs and inscriptions (the latter including a number of inscribed blocks built into houses in the town itself), and their records of these are accurate and thorough. On the occasion of the present expedition—when only two days were spent in the valley—it was not possible to pay more than cursory attention to these aspects of the ancient site, and it is therefore all the more surprising that an entirely new group of fifteen texts was found immediately to the north of the area covered by the French scholars, on the rock face overlooking the southern side of the Wadi Mu'tadil where it joins the main valley north of the *khirbah* (see plan, Fig. 4). It is clear from this that a careful search of the side valleys and other localities not visited by previous investigators might well still lead to further important discoveries.

The ruins of the ancient town itself were less thoroughly examined by the French scholars, and it was to these that the present expedition addressed itself. There are, in fact, several areas of ruins in the northern part of the al-'Ula valley, but the main site is situated between the cliffs and the railway, stretching for about 800 m. south of the entrance to the Wadi Mu'tadil—i.e. considerably farther than is shown on the French plan—and being about 250 m. wide. Its appearance is of a low, undulating mound, nowhere more than about 4 m. high, of stony rubble, very loose in places, and very much cut about by pits, in which fragments of walling are often visible (Plate 7). These pits are clearly the work of local inhabitants looking for building stone or antiquities; the process of robbing the ruins had obviously begun before Jaussen and Savignac arrived there, but a comparison of their photographs with those taken more recently show that it is accelerating, and presents a serious threat to the archaeology of the site. The entire western fringe of the site has also been destroyed by the cutting for the railway line (Plate 8), and it is certain that when this stretch of the line is repaired, as is intended, much greater damage to the ruins will ensue. Khirbat Khuraybah is therefore a very much threatened site.

The most prominent feature of the ruins—noted by Jaussen and Savignac and other visitors—is a large circular cistern, 4.25 m. in diameter and 2.15 m.

[23] *Mission Archeologique en Arabie*, II, p. 29 ff. and plates.

[24] The reader is referred to the plans in Jaussen and Savignac, *op. cit.*, plates VIII and XX.

deep, cut from a single block of sandstone (visible on the right of Plate 7). The French investigators also recovered parts of three statues and four inscribed statue bases in the vicinity and planned a few fragmentary walls; their interpretation of this particular area as the site of a Lihyanite sanctuary is reasonable.[25] Unfortunately, the present expedition had no time to examine the spot more closely. Farther north, however, on the extreme edge of the *khirbah*, the outlines of two other structures were traced, neither of them having previously been recorded. The southerly, A on the plan (Fig. 4), was about 65 m. square, and had remains of towers at its corners and midway along its sides; it was apparently a fortified defensive position. A little to the north was a second structure (B), larger than the first (*c*. 100 x 75 m.) and apparently containing three compartments. This also had the appearance of a military work, and was set between two massive stone walls, *c*. 270 m. long, which ran right up to the face of the cliff on the east and as far as the railway cutting on the west.[26] It is conceivable that they originally ran farther in this direction, perhaps to the opposite side of the valley, but their course is lost in the modern fields (which, it may be noted, now extend much farther north in the valley than they did in Jaussen's and Savignac's day). Apart from the general lay-out, few details of these structures could be observed on the ground; the lines of their walls were represented by no more than embankments of rubble or by depressions where robbing had taken place. Their plans, as recorded here, are tentative, and their function uncertain; but they are clearly important and would repay further investigation.

The only other feature to add to the plan of Jaussen and Savignac is a long wall, or dam, 750 m. long, running on a slightly curving course across the entire width of the Wadi Mu'tadil, some 650 m. east of the railway track (Plate 9). The wall is mostly buried beneath sand which has piled up against its faces, but where visible the masonry structure is 2 m. wide, and is composed of small sandstone blocks. At about 150 m. from its northern end a square tower, 14 x 14 m. projects from its eastern—i.e. upstream—face. The structure would seem to have served the double purpose of providing a defensive line across this important wadi, which forms the main route east from the al-'Ula valley, and a barrier to divert flood waters from the wadi into regular channels, and therefore away from the fields which must once have surrounded—as they are beginning to do again—the site of Dedan.

[25] *Ibid*, pp. 56–57.

[26] It needs to be mentioned that this distance—270 m—is almost double the distance shown on Jaussen and Savignac's plans as separating the cliffs from the railway at this point. It must be concluded that the French plans are not always entirely accurate, an observation which serves to emphasise the need for a new, thorough and accurate, survey of the al-'Ula region.

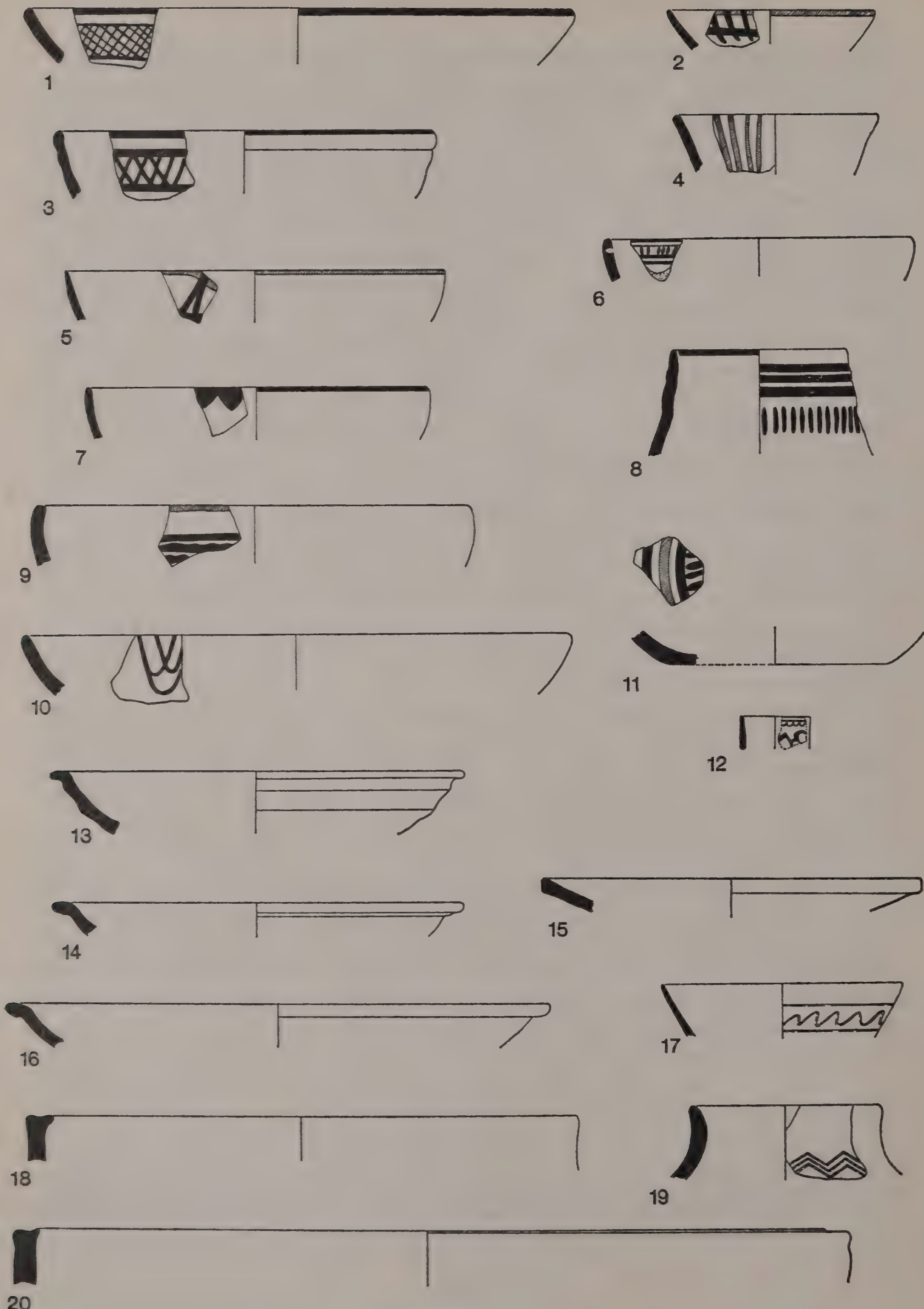
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Figure 5 Khuraybah Pottery. (Scale 1:5)

	Description	*Reg. No.*
1	Fine red ware, pink slip, black-brown paint.	K.50
2	Hard sandy pink ware, wet-smoothed inside.	K.41
3	Fine red ware, small grits. Thick pink slip and black paint. (Very weathered.)	K.55
4	Fine red ware, pink slip, red decoration.	K.48
5	Hard sandy ware. Light brown slip outside.	K.44
6	Brown ware, gritty, buff yellow slip outside. Decoration in black.	K.36
7	Hard sandy ware, fired red evenly. Fawn slip inside and outside. Decoration in black.	K.34
8	Description omitted in error.	K.82
9	Red gritty ware with fine smooth pink wash. Decoration in black and dark red-brown.	K.72
10	Dark grey, smooth ware, with fine black grits. Grey slip and black paint.	K.59
11	Hard red ware, fine grits. Black and red paint on a pink slip.	K.26
12	Description omitted in error.	K.42
13	Fine brick-red ware.	K.80
14	Fine pink ware, very hard, buff smoothed surface.	K.16
15	Very hard grey ware, some grits with greenish vitrified surface.	K.94
16	Dark grey gritty ware, fired red outside, with buff wash.	K.49
17	Red sandy ware, straw wiped.	K.69
18	Very coarse black ware with brown wash.	K.46
19	Dark grey ware, fired red on surfaces. Coarse gritty surfaces. Incised decoration.	K.11
20	Coarse red sandy ware, black grits.	K.78

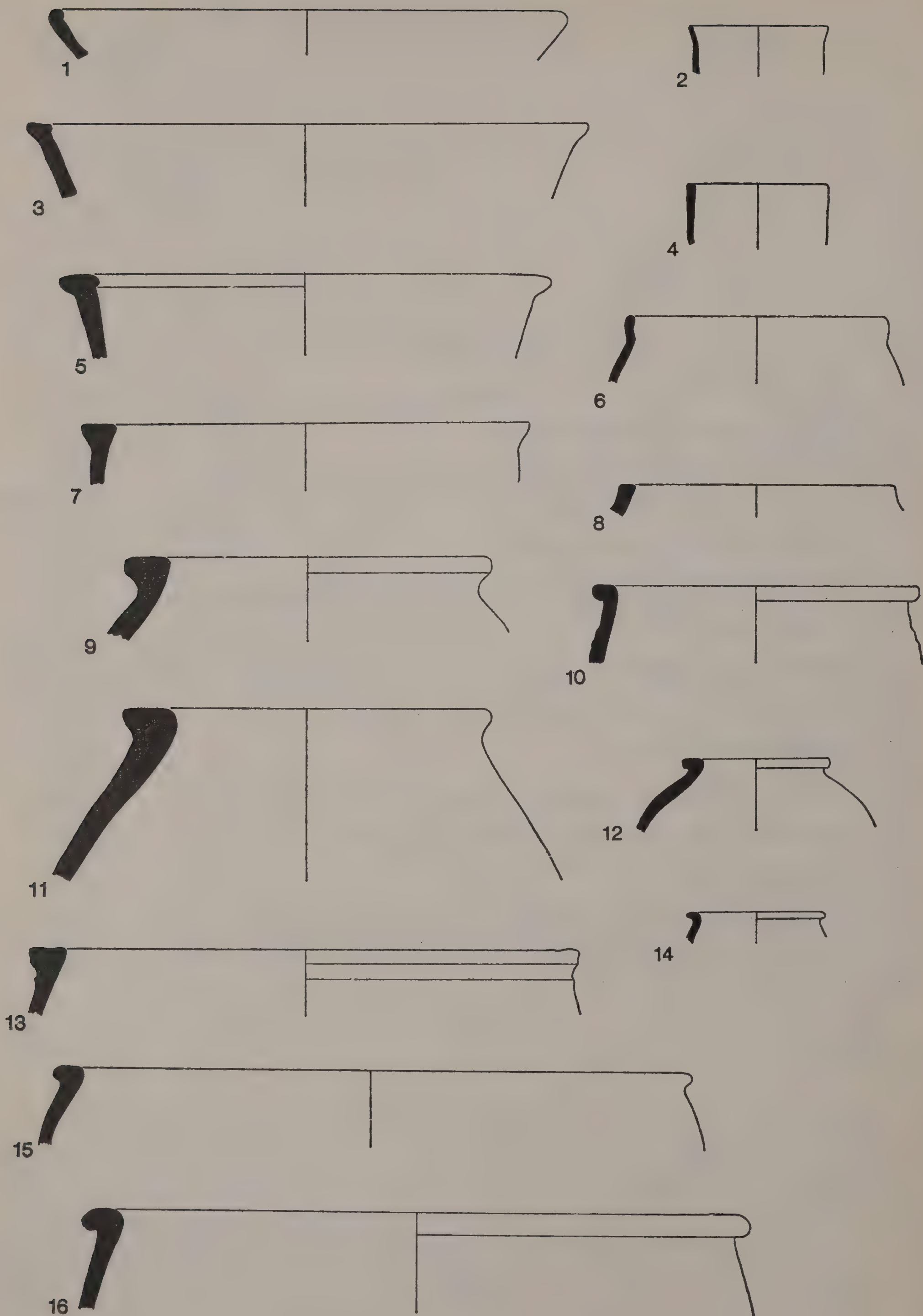
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Figure 6 Khuraybah Pottery. (Scale 1:5)

	Description	*Reg. No.*
1	Coarse red sandy ware. Brown paint on rim.	K.61
2	Fine red ware with small black grits. Red wash.	K.29
3	Pink, fairly coarse ware, gritty cream slip outside.	K.5
4	Hard gritty sandy green ware, rough green surfaces.	K.21
5	Sandy grey ware, fired brick red.	K.84
6	Purplish sandy ware, fired red on outer surface. Thick red slip outside.	K.40
7	Hard sandy dark grey ware, fired red on surfaces. Cream slip inside and outside.	K.27
8	Hard fine pink ware, greenish slip outside and inside.	K.14
9	Very coarse black ware with very large black grits, burnt red. Heavy greenish-white wash on both surfaces.	K.81
10	Hard grey-buff ware. Buff slip outside.	K.4
11	Hard purplish ware, with many fine grits. Smoothed brown exterior surface. Coil made, wheel finished.	K.1
12	Coarse red brick ware.	K.77
13	Coarse gritty, dark grey ware, fired red on surfaces. Buff-brown slip outside. Hand-made, wheel finished.	K.30
14	Fine red ware.	K.63
15	Hard purplish-red sandy ware. Greenish slip outside, grey inside.	K.31
16	Coarse red gritty ware, with cream slip.	K.9

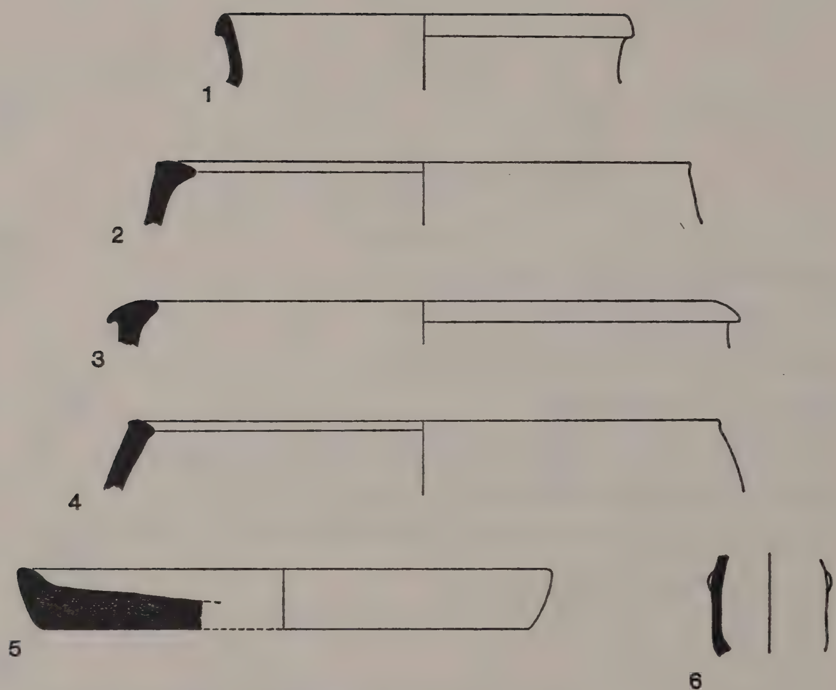


Figure 7 Khuraybah Pottery and stone. (Scale 1:5)

	Description	*Reg. No.*
1	Fine brick-red ware, with red wash.	K.96
2	Hard purplish ware, coarse black grits, dark grey slip both sides.	K.10
3	Very coarse, gritty, greenish ware, with a greenish wash.	K.54
4	Hard brown ware, very fine grits, greenish slip outside and on rim. Inner surface grey-brown.	K.33
5	Stone bowl; close-grained grey sandstone.	K.102
6	Alabaster.	K.20

A selection of the pottery picked up from the *khirbah* is shown on Figs. 5–7 and Plate 41. Most distinctive—though forming an actual minority of the sherds—are fragments of painted vessels, mainly straight-sided bowls (Fig. 5, nos 1–7) but including a few other shapes (Fig. 5, nos. 8 and 12). All are wheel made, mostly of a hard sandy ware, varying in colour from red to brown; three examples of a finer ware (Fig. 5, nos 1, 3 and 4) and one of fine grey ware (Fig. 5, no. 10) are also published. The surfaces, both inner and outer, are typically covered with a slip or wash in the colour range of pink, buff, or yellow, and simple geometric designs are painted in black, occasionally with the addition of a reddish-brown, on the inside of the bowls and the outside of the jars. Apart from this painted ware, the only form of decorated pottery consists of a relatively very small number of incised vessels (Fig. 5, nos. 17 and 19), also in rough sandy wares; the incised decoration is quite unlike that already noted as occurring on the Ma'abiyat pottery. As for plain pottery, forming the bulk of the material, this is also mostly coarse and gritty, often very much so, though some of the bowls are finer (e.g. Fig. 5, nos. 13, 14, 15 and Fig. 6, nos. 2, 8). Cream, buff and brown slips are not uncommon, and particularly distinctive are vessels with a greenish surface (e.g. Fig. 6, nos. 8, 9 and 15); again, these are different in feel from the greenish wares of Ma'abiyat. All the plain vessels are wheel made except for some heavy jars (e.g. Fig. 6, nos. 11 and 13) which are hand, or coil built. The most typical shapes of the plain vessels are shown in the accompanying drawings; they are mostly bowls and jars. In addition to the pottery the only other objects recovered from the surface of the ruins were the tip of a bronze arrowhead and fragments of an alabastron and a stone platter (Fig. 7, nos. 5 and 6).

A detailed comparative study of this material would be quite out of place at this stage of our knowledge of Arabian archaeology. A casual search would no doubt reveal many tempting analogies, in ware and style, to the Khuraybah pottery, but comparison and analogy are methods which, as Ibn Khaldun pointed out six hundred years ago, 'easily lead to error; should they by any chance be accompanied by inattention and hastiness, they can lead the searcher astray, far from the object of his enquiry'.[27] It is safer to await a time when more local material is available, with perhaps external chronological controls. One suggestion may be advanced, however. The ruins of Khuraybah do not have the appearance of spanning a very long period of time, and this conforms with the evidence of the monumental epigraphy of the site, which dates from between about the sixth and the first centuries B.C. Three of the statue bases found by Jaussen and Savignac are dated by Albright, following Winnett, to the late fourth or early third century.[28] They were found, according to their discoverers' description, on or just below the surface of the ruins, and this surely suggests that the final major occupation of the site is to be dated not earlier, and probably not much later, than about this time. Much of the pottery which we have been considering must also come from this final occupation, and would therefore date to what are conventionally called the Persian and Early Hellenistic periods. It is worth noting in this connection that, despite the proximity of Khuraybah to the Nabataean site of Meda'in Salih, and despite the oft-quoted statement that the Nabataeans occupied Dedan in the first century B.C., not one sherd of Nabataean or contemporary Late Hellenistic/Roman pottery was found in the al-'Ula valley. Nor is there anything Nabataean about the

[27] Ibn Khaldun, *Al-Muqqadimah*. (Translated and arranged by Charles Issawi, *An Arab Philosophy of History* (1950), p.31).

[28] Albright, *op. cit.*, p. 6.

tombs, rock-carvings and sculpture. The only Nabataean remains in the valley are a few dozen graffiti, published by Jaussen and Savignac, and testifying to no more than the passage of Nabataean travellers and soldiers along this route. The archaeological facts presently available strongly indicate that Dedan was abandoned when Hegra (Meda'in Salih) took its place as the commercial centre of this part of Arabia. The above suggestions are tentative and subjective, but they might perhaps be of some value in helping to create an hypothesis on which to base further comparative study of the Khuraybah remains, in the hope of avoiding the dangers adverted to by Ibn Khaldun.

Al-'Ula Museum

During the expedition's stay in al-'Ula a short visit was paid, at the invitation of the local authorities, to the small municipal museum, to record the unpublished pieces amongst the collection of inscribed blocks and other objects which is being preserved there. Apart from three new texts the main discovery was of two male statues, additional to those found by Jaussen and Savignac.[29] Both are of sandstone, and the first (Plates 10 and 11) is complete except for the head and lower legs; its preserved height is 1.10 m., and it is thus smaller by about one-third than the two main statues (A and B) published by the French archaeologists. It is also of rather different workmanship and style, in that it is more muscular and angular, and the costume is slightly different, the loin-cloth being shorter, with the belt worn lower on the hips and tied on the right, instead of the left, side. In all these particulars it much more resembles the fragmentary third statue found by Jaussen and Savignac.[30] The back of the piece is only schematically worked, and there are protruding blocks of stone left behind the neck and the legs, as in the case of the French statue B. The second figure in the museum (Plate 12) is less well preserved, having its head, arms, and all of its legs missing. The remaining torso is no more than 0.60 m. tall; it is slender and high-waisted, and less realistically modelled than any of the other statues. Little can be seen of its dress except for a broad belt, incised with vertical lines to represent pleats or decoration, quite unlike the belts of the other figures. Its back, also, is left unworked. It is not known whether these two newly recorded statues come from the same area of the ruins as did those discovered by Jaussen and Savignac, but it is clear that they served the same function of lining the walls of some important hall or temple.

One other carved stone in the museum is worth noting (Plate 13). It is a squared building block, about 0.75 m. long, adorned with a frieze of three ibexes, schematically carved in low relief. It recalls the rather more competently executed frieze found on a fragment of a column by Jaussen and Savignac.[31]

[29] *Mission Archéologique en Arabie*, II, p. 58 ff., and plates XXVIII–XXXI.

[30] *Ibid*, plate XXXI, 3.

[31] *Ibid*, plate XIX, 2.

Rawwafah

The isolated temple of Rawwafah (Plate 14) lies in the central Hisma, on the edge of one of the largest of the lava fields (the Harrat ar-Raha), about 75 kms. south-south-west of Tabuk and the same distance due east of Muwailah on the Red Sea coast. The only visitors prior to the present expedition who have left descriptions of the site are Musil[32] and Philby[33]. The former's visit, in June 1910, was of but a few hours' duration, and was marred by the unfriendly attitude of the local bedouin and by the fear of smallpox; his preoccupation with these matters no doubt explains the grossly inaccurate nature of his sketch plan. Musil did, however, discover several inscriptions at the site, and although his records of these were later stolen and never recovered, it is to him that must go the credit for having drawn the attention of the scholarly world to the existence of this important ruin. Philby spent longer at the site in 1951 and 1952, and his description of it is detailed and reasonably accurate, though (as will be seen) it omits one or two important features. He does not seem to have drawn any plan of the building, though a plan based on his description (and therefore not entirely accurate) has been published by Grohmann.[34]

Despite Musil's remarks to the contrary, the remains of the Rawwafah temple are quite well preserved, and its design is not at all difficult to make out (see plan, Fig. 8). The building is almost square, its outside measurements being 13.20 x 11.20 m. The entrance, 1.55 m. wide and with rebated reveals, is in the centre of one of the shorter sides, and faces 15° south of east. Within the doorway is what is probably (as Philby suggested) an open courtyard, 7.50 x 9.60 m., though it should be noted that the débris which fills this court could easily conceal the bases of columns which once supported a roof over all or part of the area. The western third of the temple comprises three compartments, the two outer ones being rooms about 3 m. square internally, while the space between them, some 4 m. deep and 2 m. wide, no doubt forms the *adyton*. The upper part of the doorway to the north-west room is still plainly visible from the courtyard (Plate 15), though it is hidden by fallen masonry in the room itself, and was, presumably for this reason, missed by Philby, and does not appear on Grohmann's plan. Judging from the relative levels of the ground outside the temple and the lintel of this doorway, there is no reason to follow Philby in thinking that the floors of the rooms in the north-west and south-west corners were a metre or more higher than the courtyard. The south-west room is less well preserved than its companion, and although the lines of its walls are certain there is no actual evidence for its doorway. It seems reasonable to suppose that the arrangement is symmetrical, however, and a doorway has been shown on the plan corresponding to that of the north-west chamber. The walls of the two

[32] Musil, *The Northern Hegaz* (1926), pp. 185–189.

[33] Philby, *The Land of Midian* (1957), pp. 144–149 and p. 154.

[34] A. Grohmann, *Arabien* (1963), p. 71.

chambers are bonded with the main walls of the temple, and are undoubtedly of the same period. As Philby has already remarked, there is nothing to indicate what form the roof of the temple took, and nothing to show how much higher the building stood than the 4.60 m. which is the height of the highest surviving wall.

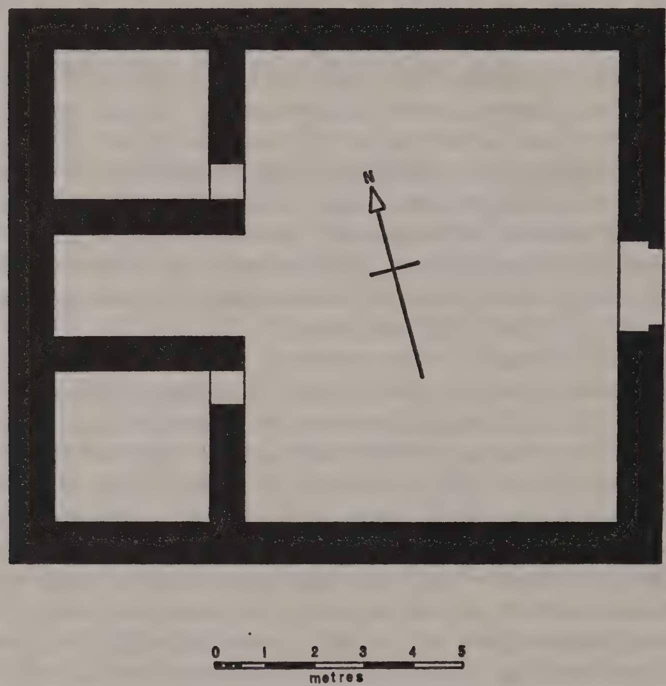


Figure 8 Rawwafah. Plan of temple

The main walls of the temple vary from 0.80 to 0.90 m. in thickness, while the interior walls are slightly less than this. The masonry of the main walls comprises an outer facing of large ashlar blocks of whitish sandstone (Plate 14), with a core and inner face of much smaller, irregularly coursed stones (Plate 16). The external appearance of the west wall—the only one preserved to any height—is particularly attractive; the blocks are dressed with a very fine irregular combing, with a smooth margin of 2 to 3 cms. all round; the largest of the blocks are well over a metre in length. Some of the blocks in the east wall of the temple have diagonal tooling, however, and it is probable that the whole of this front wall was finished in this way (Plate 17). The heights of the courses vary considerably, from a maximum of 39 cms. to a minimum of 19 cms.

There is nowhere any trace of stucco or of the plugs and sockets for affixing this (as, for example, on the Qasr el-Bint at Petra), and it is clear that the outside of the Rawwafah monument was not treated in this way. The inner faces of the main walls of the temple, as well as the walls of the interior chambers, are, on the other hand, so roughly constructed that it is impossible to imagine them in their original state without a stucco facing, now destroyed.

There are very few architectural mouldings lying amongst the fallen débris in and around the temple, and it must be assumed that the building was not embellished in this fashion, except over the main entrance, where a lintel carried a bilingual Greco-Nabataean dedicatory inscription (Plate 17). This dedication, copied originally by Musil, described again by Philby, and referred to by Seyrig[35], Grohmann[36], van den Branden[37], etc., has never been published in its entirety; it was re-photographed and copied by the present expedition, and will be definitively published by J. T. Milik in Part II of this report, in advance of its appearance in the *Corpus Inscriptionum Semiticarum* II (edited by J. T. Milik and J. Starcky). It dates the foundation of the temple to the joint reign of Marcus Aurelius and Lucius Verrus, some time between the middle of A.D. 166 and the beginning of 169, and it attributes it to the 'nation' or 'federation' of the Thamudeans. It is carved on a block of sandstone, 2.70 m. long, 0.35 m. deep and 0.35 m. wide, with a simple fascia and cornice; the mouldings of the latter are too worn to be described. An angle pilaster capital, better preserved (Plate 18 and Fig. 9) and bearing a short Greek text, was also found; its dimensions are compatible with its having supported the southern end of the lintel, and this is confirmed by the text, which forms part of the main dedication. Another fragmentary Greek inscription, found by Philby and published by Seyrig[38], but not seen by the present expedition, comes, according to Milik, from the corresponding pilaster capital on the northern side of the entrance. (It should be noted that these capitals do not have corresponding pilasters flanking the entrance to the temple, the jambs of which are quite plain.)

The only other stones worthy of note lying in the débris were (i) a few ashlar blocks with diagonal tooling; (ii) sections of a plain chamber moulding (including an angle piece, Plate 19); and (iii) a flat slab, some 0.75 m. square and 0.20 m. thick, with a square depression carved in its underside and a round hole pierced completely through the centre (Plate 20). This latter stone, which Philby had already noted, bears on its upper surface two worn *tabulae ansatae*, in the lower of which a few letters of a Nabataean text can be made out; this inscription had, strangely enough, escaped Philby's notice. Although it is impossible to be sure, it seems likely that the inscription is earlier than the hole through the stone, which would then be the product of a later re-use.

[35] H. Seyrig, *Syria* XXXIV (1957), pp. 259–261.
[36] Grohmann, *op. cit.*, p. 71.
[37] A. van den Branden, *Histoire de Thamoud* (1960), pp. 15, 22–23, 29, etc.
[38] Seyrig, *op. cit.*, p. 260.

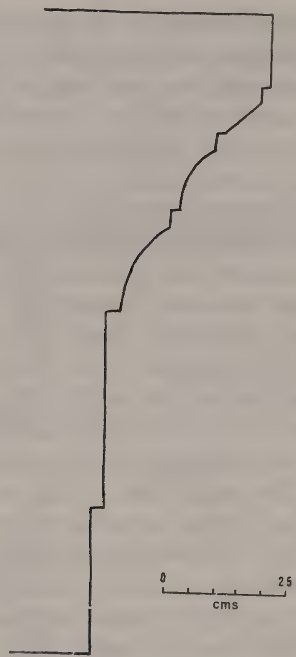


Figure 9 Rawwafah. Profile of Pilaster cap

About 35 m. north of the temple the remains of a secondary structure are visible, also described by Philby. This is rectangular, 5.25 x 3.80 m. internally; the walls are very much destroyed and low on the ground, and no external faces are apparent; there are no signs of interior partition walls, and Philby's interpretation of this structure as a cistern is surely correct. A rough pile of stones in the middle seems to be of a different period, and could be a later bedouin grave; a number of similar graves occur in the area between the cistern and the temple. The only other structure in the vicinity is a circle of rough masonry, about 1.50 m. in diameter, to the east of the temple, some distance in front of its entrance. Musil shows this on his plan as a well-head, and such it may be. There is no evidence for a proper settlement at Rawwafah—no surface sherds were found—and the reason for the construction of a solitary temple at this relatively isolated spot remains something of an enigma. Philby's suggestion, that Rawwafah was a sort of popular hunting and picnic spot for the ancient nobility, on account of its perennial water supply (in pools in a nearby cave), may be true, and the somewhat earlier Nabataean temple at Wadi Rumm, in Jordan, is another example of a sanctuary built near to a sacred spring. The Rawwafah water pools may also have been sacred. But Wadi Rumm was more than a pleasure resort; it was a major trade route of the Nabataeans. It may

therefore be postulated that Rawwafah also lay on a well-beaten track in antiquity, and that its pools and its temple afforded travellers refreshment both physical and spiritual. This track is no longer, it seems, of much importance, and even its route is becoming forgotten by the truck drivers who dominate the modern caravan trade. But it deserves further examination, since other ruined sites may well lie along its course.

Finally, it remains to ask what cultural epithet might best be given to the Rawwafah temple. On the authority of the dedicatory inscription both Seyrig and van den Branden refer to it as a Thamudean sanctuary, and they are clearly right in one sense. Yet the Thamudeans—a group of nomadic or semi-nomadic tribes known otherwise only from the thousands of graffiti left by them, in the Thamudic script, throughout North Arabia—cannot be supposed to have been the originators of a distinctive architectural tradition, and it is clear that the temple they built—or had built—at Rawwafah is no native North Arabian monument. It is, in fact, built to foreign specifications. The plan, with broad cella and rooms flanking the small adyton, is generally considered to be of Assyrian or Syrian origin, though the closest parallel to the Rawwafah plan is provided by the temple at Yeha in Ethiopia, considered to be of South Arabian workmanship of the fifth century B.C.[39] The mode of construction of the Rawwafah monument, and especially the diagonal stone dressing, are best paralleled in Nabataea. The languages of its inscriptions point the same way: Greek for prestige, but Nabataean because this was the monumental script and the literary language of the region. There can be no doubt that the Rawwafah temple is, strictly speaking, a Nabataean building, despite the fact that it was erected over a half a century after the eclipse of the Nabataean kingdom. Its archaeological importance lies in this, that it is one of the very few precisely dated Nabataean structures known, and affords the student of Nabataean architecture a fixed chronological point of inestimable value.

Qurayyah

The site of Qurayyah is in many ways the most important and complex of all those visited by the expedition, and despite the fact that several days were spent there in the examination of the remains, a considerable amount of further study is required before an accurate and comprehensive account can be given. It is intended to make this study one of the main projects of the next season of fieldwork, after which a full report will be published. For this reason only a summary of the data collected in 1968 is presented here.

The site is 70 kms. north-west of Tabuk and 26 kms. west-south-west of Bir Ibn Hirmas, the Saudi Arabian customs station on the Hejaz Railway. It is

[39] *Cf.* E. Will, 'L'adyton dans le temple syrien de l'epoque imperiale', in *Etudes d'Archéologie Classique* II (*Annales de l'Est*, *Memoire* No. 22), 1959; and G. R. H. Wright, 'Structure of the Qasr Bint Far'un', in *P.E.Q.* 1961, p. 8 ff.

just over 60 kms. from the Jordanian frontier at Muddowwerah, and is close to the track from Tabuk to Haql and Aqaba. It lies in the narrow tract of country known as the Lihh, forming a fringe along the western edge of the Tabuk basin (al-Muhtatab) between it and the Hisma plateau. The Lihh is an area of broken sandstone and shale hills, crossed by innumerable wadis, dry for most of the year but carrying a great amount of flood water after the storms of winter and early summer. This water reappears as springs and wells in the Tabuk basin, but in the Lihh the configuration of the land is such that it can be more immediately utilized by means of dams and channels. Philby[40] has described a number of ancient agricultural settlements in the area which were once dependent upon such flood-water irrigation. Qurayyah is apparently the largest of these, and is the only one so far visited during the present survey. Its relative importance can be judged from the number of times it is mentioned in the annals of the early explorers of the region. Wallin, on his way from Muwailah to Tabuk in 1848, was told of the place, and of a ferocious black dog which guarded it. Burton and Doughty also both knew of it, but Moritz was the first European to visit the site in 1906, and he has left a good, though brief, description, together with copies of a dozen or so graffiti (Thamudic, Nabataean and Kufic) he found there.[41] Since then only Philby has explored the site; his account of the visible remains is, as usual, thorough and accurate, though it is (as is also usual) unaccompanied by any plan and illustrated by only a few uninformative photographs.[42] In the description which follows no attempt is made to collate the earlier accounts with our own, and the plans (Figs. 10 and 11), provisional and approximate though they are, are largely left to speak for themselves.

The Qurayyah ruins consist of a number of separate, though intimately related, parts. The most striking feature is an isolated hill (Plate 21) of what is perhaps best described as a grey-green siltstone, very weathered and brashy. It is about 1 km. long and 350 m. broad at its widest point; its long axis is orientated approximately east to west. The summit of the hill is steeply ridged, with the crest running along the long axis; its highest point is some 50 m. above the level of the surrounding wadis. The hill is protected on practically all sides by sheer cliffs, which explain and justify Philby's designation of it as the Citadel Hill. Only at the western end is the rock face sufficiently low and broken to provide a means of ascent, and it is clearly here, probably in the south-west corner of the hill, that the ancient approach was located. The summit is divided into three parts by two stone fortification walls, which stretch right across from cliff to cliff (Plate 22). The western part, which is the lowest and the first attained after climbing the hill, is devoid of any signs of occupation other than a very few sherds, and it was obviously outside the citadel proper. In the middle

[40] *The Land of Midian*, pp. 127–129, 177, 184–187, etc.

[41] B. Moritz, *Mélanges de la Faculté Orientale*, Université Saint-Joseph, Beirut, Vol. III (1908), pp. 399–415.

[42] *The Land of Midian*, pp. 171–184.

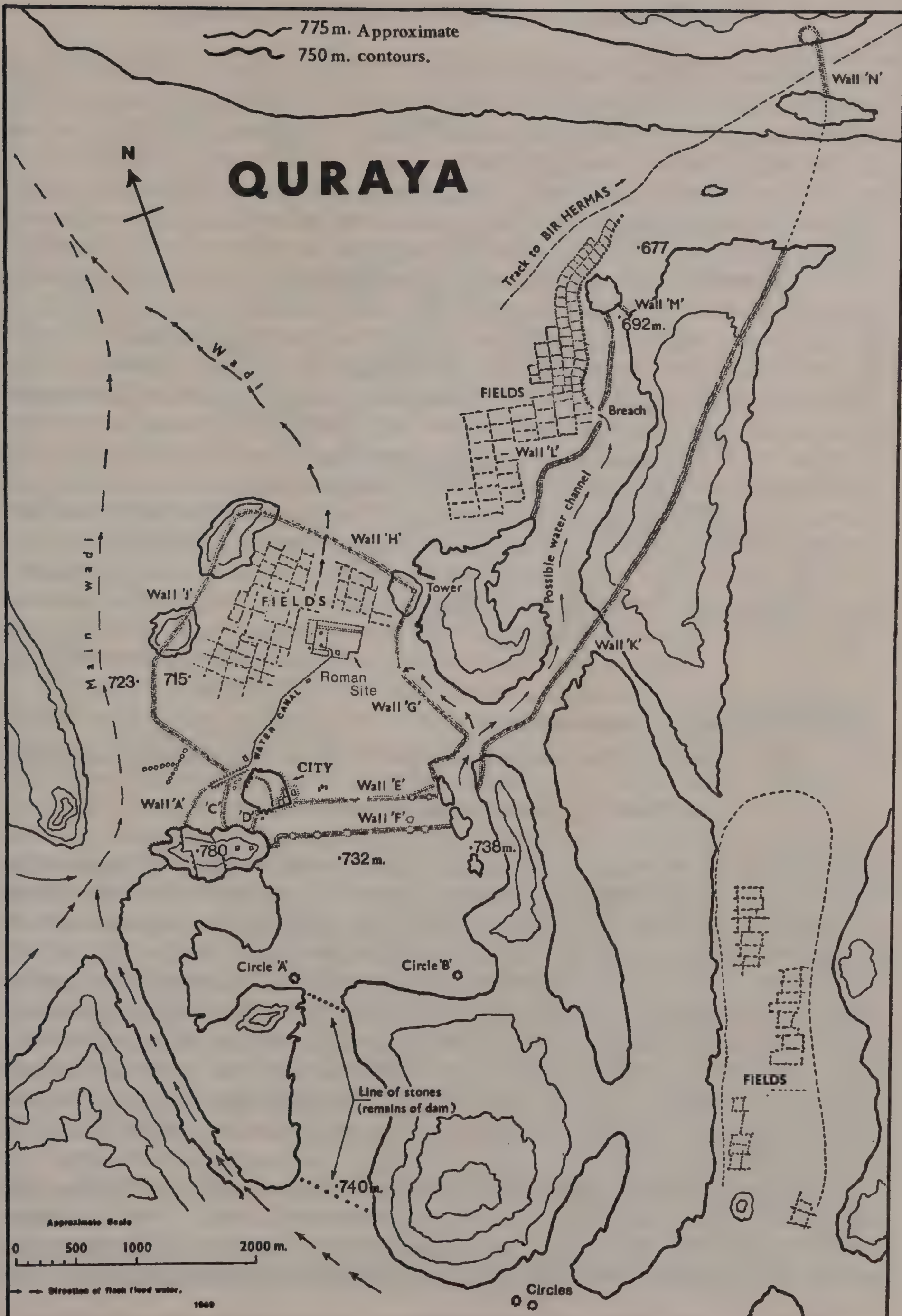


Figure 10 Qurayyah. General plan

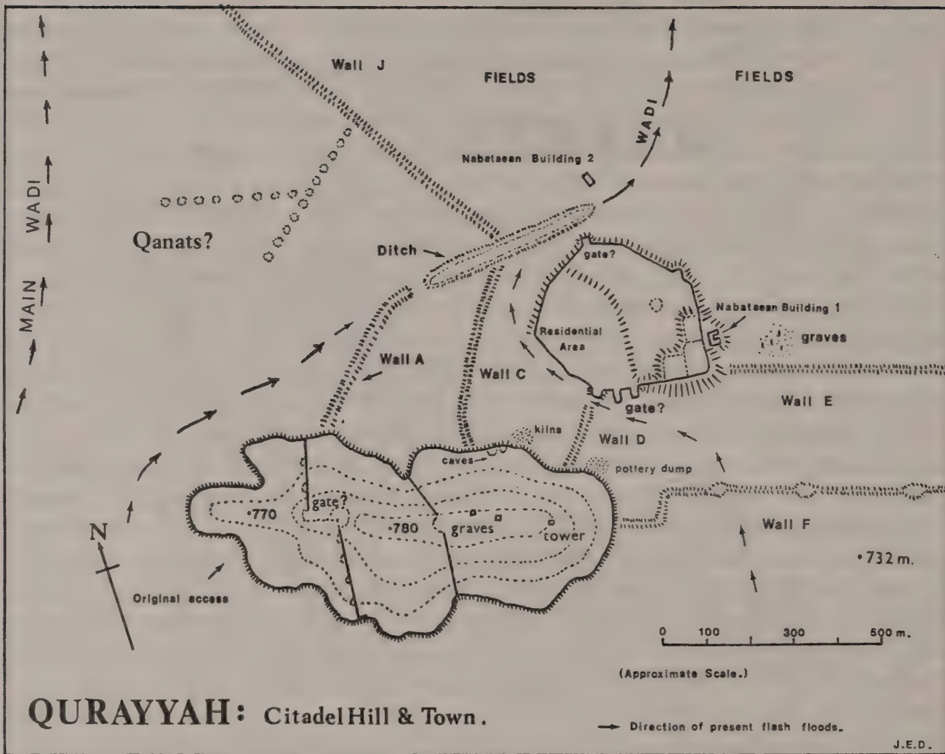


Figure 11 Qurayyah. Plan of citadel and town

section, however, between the two walls, there are visible a number of circular depressions in the surface of the ground, some 2 m. or so in diameter, which could conceivably mark the remains of buildings, while quite a large amount of pottery was picked up near by. This part of the summit might well be termed the 'outer bailey' of the citadel. The eastern section—the 'inner bailey'—has similar evidence of occupation, together with a number of better-preserved structures which will be described shortly. However, it should be stressed that, even allowing for the massive erosion which has clearly affected the summit, there is nowhere any suggestion of any very elaborate structures upon it (apart from the fortifications), and it is thus clear that this was not the main residential area of ancient Qurayyah.

The two cross walls, which still stand in places to well over 3 m., are constructed of thin, flat slabs of the local siltstone set in mud. They are about 1.40 m. in thickness, and have vertical faces, except for a part of the southern section of the western wall, the outer face of which is slightly battered. The

most distinctive feature of their construction is the way in which they are built in separate unbonded sections, each about 3 to 4 m. long (Plate 23), the reason for this presumably being to localize any collapse due to earthquake or hostile action. (Jaussen and Savignac noted the same feature in the walls of Tayma, and indeed the Qurayyah walls bear a very close resemblance to these in every way, judging from the photographs published by the French scholars.)[43] The lines of the two walls can best be seen from the accompanying plan (Fig. 11). Although there are several gaps in each, where collapses have occurred, it is not at all clear where the original gates lay. The most likely place would be on the ridge of the summit, and a break at the re-entrant angle in the outer (western) wall is probably the site of its entrance. The corresponding position on the eastern wall is occupied by a large semi-circular tower, which could also reasonably be associated with a gate. This was the only tower in the eastern wall, apart from two small solid buttresses supporting the inner face of its southern part. The western wall had a series of towers, however, two in its northern half and four in its southern, as well as a larger bastion protecting the re-entrant. The two northern towers were square, about 3 x 3 m. in size; of the four southern towers (which were of about the same dimensions) two were square and one was semi-circular; the fourth was too much destroyed to reveal its shape. None of these towers was bonded with the main wall (Plate 24) except for one, where the upper courses of wall and tower did appear to be bonded.

Of the other structures on the hill, the sub-annular depressions which may indicate underlying buildings have already been mentioned. Just east of the re-entrant and possible gate in the western wall is a mound of stones which, in so far as it is not natural, may be a ruined building or a burial cairn. Along the crest of the summit in the eastern enclosure there are a number of low square masonry structures which appear to have been disturbed or excavated since their original collapse. Their débris contains much pottery (to be discussed below) and a few bones, and the structure would seem to have served, at least at some point in their history, as graves. One of them, the best preserved, is 5.35 m. square externally, with walls 0.80 m. thick, constructed of similar masonry to that of the fortifications (Plate 25). There is an entrance 1 m. wide in the centre of the eastern wall. The walls stand on average about 1 m. high above the present ground surface inside the chamber, which is very much encumbered with debris, and in the corners, at about 0.60 m. above the present surface, the beginnings of corbelling can clearly be seen. This structure, especially, has a great amount of pottery and bone in the débris surrounding it; one fragment of bone has been identified as part of a human skull.[44] Whether this burial is an original or secondary feature cannot be said from the present evidence.

[43] *Mission Archéologique en Arabie*, II, p. 152 and plate LXIV, 1.

[44] We are indebted to Dr. Ian Cornwall for this identification.

At the far eastern end of the citadel stands an isolated tower, 3.70 m. square externally, with slightly battered walls (Plate 26). Its masonry is identical with that of the fortification walls and the chamber just described, but, unlike the latter, it stands to a height of 4 m. where best preserved. Half of it has almost completely fallen, and nothing can be seen of its interior or of its original entrance. A superficial examination suggested, however, that the upper part of this tower may have been solid, in which case it might be postulated that the lower part had originally contained a corbelled chamber similar to that farther west, described above. Assuming that the burial associated with the latter chamber was an original feature, the suggestion may therefore be advanced that both of these structures were funerary towers.[45] However, it must be admitted that this is pure speculation, in the present state of investigation, and the eastern tower may equally well have served a military purpose, as Philby supposed.

Below the citadel, about 200 m. from the foot of its cliffs on the north-east, lie the ruins of the ancient settlement itself (Plate 24). This is an irregular polygon in plan, about 400 x 300 m. in size, and is surrounded by a circuit wall, now largely buried in debris and visible only as a high bank. In those few places where the actual wall protrudes above the bank, stretches of both crude mud-brick and of stone masonry (similar to the masonry on the citadel) are discernible, but whether these are contemporary or indicate successive phases of construction cannot be said. At one point in the circuit there are signs of two parallel stone walls, each a little over 1 m. wide and about 4 m. apart, but whether this is a fortification constructed on the casemate principle is also unknown. There are also several features indicative of gateways through the circuit walls, but these require closer investigation before they can be described reliably. Within the walls, the western half and the south-east corner of the site are occupied by a mass of débris, in which the outlines of stone structures occasionally are traceable. The estimated height of the débris in the south-east is about 8 m.; elsewhere it is somewhat lower. The central area between the two mounds of ruins is occupied by a flat area devoid of remains; this may have been the site of an open market place, or conceivably of a pool or reservoir.

The ruins of the settlement are connected to the foot of the citadel by a wall (Wall D on the plan, Fig. 11) which resembles the circuit wall of the settlement in that it is built partly of mud-brick (Plate 29) and partly of stonework, and is between 1.0 and 1.25 m. in thickness. Farther west the lines of two similar walls (A and C) are visible, while other structures of the same nature can be traced over an extensive area north and east of the settlement, and are shown on the plan, Fig. 10. The most continuous line of such structures is that composed of Walls E, G, H, and J, enclosing an area of approximately 4 sq. kms.,

[45] Certain similarities between these structures at Qurayyah and the tombs at Rujum Shauhar, south of Tabuk, described by Jaussen and Savignac (*Mission* . . . vol. II, pp. 168–176) and Philby (*Land of Midian* pp. 127–129) may be noted.

while other walls, for example, K, L, and M, are even more far-reaching, extending to a distance of some 6 kms. from the main site. For much of their courses these walls present today the appearance of long ramparts of earth and stone (Plate 27), varying considerably in height from place to place, and it is indeed conceivable that they are in part not true walls at all, but embankments. However, in many places actual masonry is visible (Plate 28), and this is again identical with the masonry of the citadel and town walls already described. The exact nature and function of these structures cannot be meaningfully discussed until a more detailed survey of the site has been made, but it is already clear that while some of them (for example Walls F, L, and N) may have served as dams to divert flood waters in the wadis, their primary purpose was to protect (from run-off water and blown sand) the areas of fields which they enclose. These fields are clearly visible at several places in the wadi beds surrounding the Qurayyah settlement, their outlines being marked normally by low walls consisting of a single line of stones (Plates 31 and 32). Sometimes double lines of stones are preserved; these may either be the surviving faces of thicker walls which have lost their rubble core, or the remains of irrigation channels (Plate 30). That the fields were irrigated is proved by the existence in a number of places of stone sluices which, on account of their more robust construction, have survived even when their accompanying water channels (perhaps sometimes of embanked earth only) have disappeared.

Before leaving the question of irrigation at Qurayyah (of which, as has been said already, little cogent discussion is possible without more detailed field work) one more feature must be noticed. Just outside the main area of fields, between Walls A and J, are two lines of shallow depressions in the wadi bed, forming a Y in plan (Fig. 11). These are very suggestive of a *qanat* irrigation system, such as are well known in other parts of the Middle East, including the Arabian peninsular, and which are usually considered to be of Persian origin. No other signs of such a system were seen at Qurayyah, and this was clearly not the principal mode of irrigation.[46] But it is not inconceivable that it was a secondary device utilized during the summer months, when the wadis would be dry and flood irrigation impossible.

Perhaps the most striking feature of the ruins so far described at Qurayyah is their homogeneity, reflected most clearly in the identical masonry used for the citadel fortifications, the town defences, and the enclosure walls. There can be little doubt that all these structures and their appendages are contemporary with each other, and are all part of one basic design. The date of this is indicated by the masses of pottery picked up all over the site, and to this we shall return. Before doing so, however, it is necessary to describe a number of other

[46] Philby, however, noted a similar line of 'manholes' at a site a few kilometres away (*Land of Midian*, p. 185).

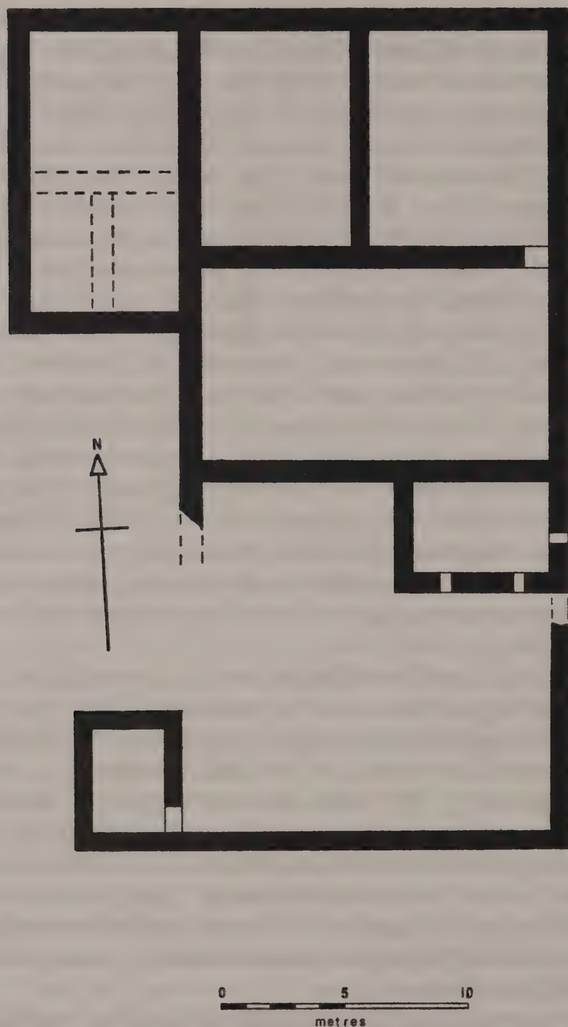


Figure 12 Qurayyah. Plan of Nabataean Building I

remains at Qurayyah which are probably, and in some cases certainly, of a different nature and period. To begin with, there are, close to the town site but outside it, two buildings quite unlike anything we have yet described. These have been designated Nabataean Buildings I and II, for reasons which will be soon apparent. Their plans can be seen on Figs. 12 and 13, and only the briefest descriptions will be given here. The first (called by Philby the 'Palace'[47])

[47] *Land of Midian*, pp. 180–181.

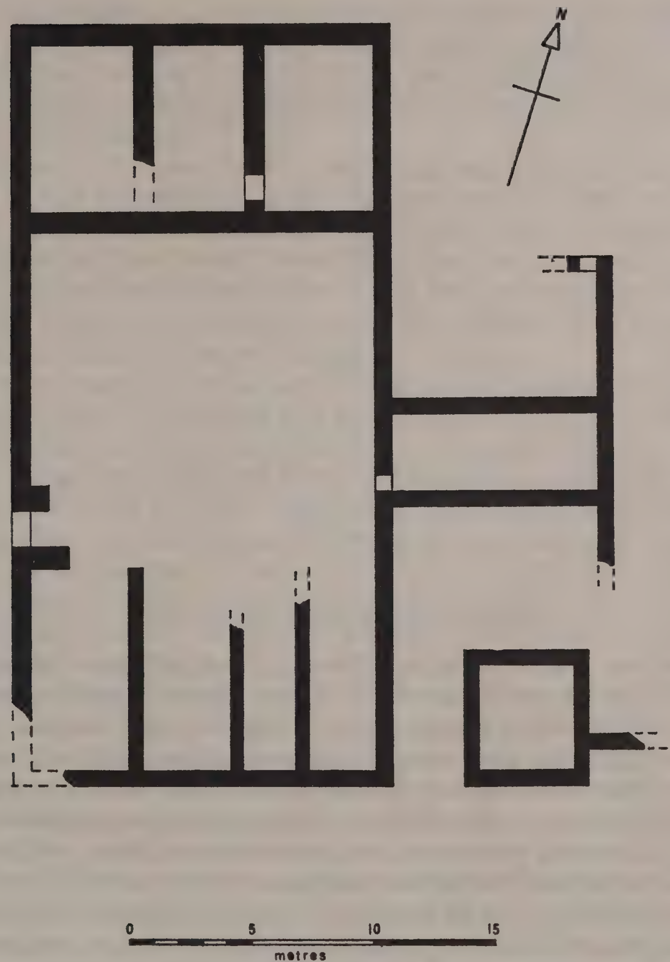


Figure 13 Qurayyah. Plan of Nabataean Building II

is only a dozen metres or so outside the town walls and seems, from surface indications, to have been constructed after those walls were already in ruins (Plate 33). Its own walls are rather well preserved in places, and are of an entirely different construction from the town or citadel walls. They are of conventional ashlar masonry, the blocks of yellowish-buff sandstone being typically about 0.50 x 0.40 x 0.30 m. in size, all set in mud mortar, and not particularly well dressed or coursed; in appearance the masonry compares unfavourably with that of, for example, the Rawwafah temple (Plate 34). In one place a horizontal

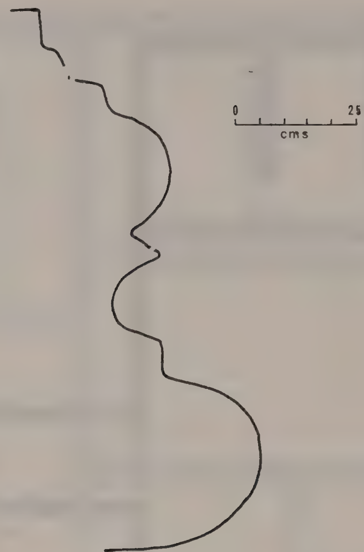


Figure 14 Qurayyah. Profile of column base

slot between two courses in the outer face of a wall indicates the cavity left by the decay of a wooden tie beam about 12 cms. square in section. The approximate date of the building is suggested by a fragment of the abacus of a Nabataean capital (Plate 35), a section of a cornice moulding, and a column base and four drums (Plate 36 and Fig. 14), the latter pieces lying in a pit dug into the ruins at some time (apparently since Philby's visit in 1951, since he does not mention them). The diameter of the base on its upper surface is 61 cms., and its moulding has been damaged and subsequently repaired with plaster. The drums are 59.5 cms. in diameter and 45 cms. deep; they are finished with an irregular diagonal tooling, with narrow margins left at top and bottom, and were originally set in a hard white mortar, traces of which still adhere to the upper and lower surfaces. The purpose of this building is not easy to determine. It is clearly (from its plan) not a temple, and although it does not seem large or grand enough to warrant Philby's designation of a palace, it might well have been the residence of a military governor or similar Roman or Nabataean official. That it was designed in part for defence is suggested by the fact that one small room has three narrow slit windows piercing its walls, in the nature of embrasures.

Nabataean Building II is less well preserved, and the lines of only some of its walls can be traced. The plan (Fig. 13) shows the main structure; but immediately to the east are other fragmentary walls of similar character and on the same axis, probably belonging to an adjacent and related structure. The masonry

of Nabataean Building II, and the presence of another Nabataean capital (Plate 37) and several ashlar blocks with diagonal tooling, prove it to be of the same date as Building I. Its plan in no way supports Philby's suggestion that it was a nymphaeum,[48] and it is perhaps more likely to have been a military or administrative building.

In one part of the area of fields about 1 km. north east of the citadel some long lines of low foundations, similar in appearance to those of Nabataean Building II, were noted. A detailed study could not be made in the time available, but the impression gained was of a number of spacious rooms associated with a very large enclosure, and the possibility is that these mark the site of a caravan-serai of the Romano-Nabataean period. The outlines of a large masonry cistern near by could also be part of the same complex.

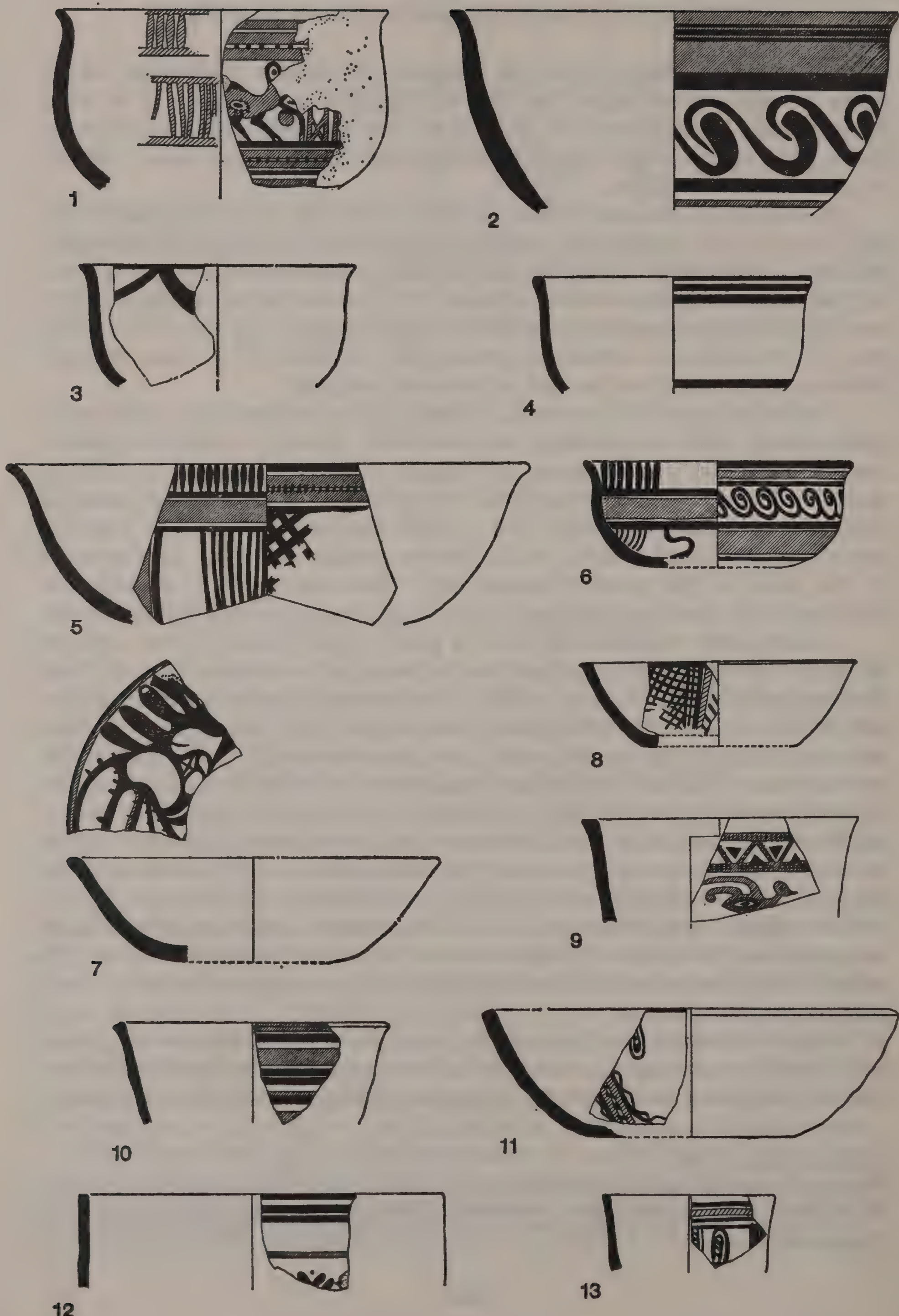
One other group of structures is, judging from its appearance, likely to be contemporary with the buildings just described; namely a number of tombs, some 100 m. east of Nabataean Building I. Some of these are amorphous mounds of stones, but others are masonry structures, square or rectangular in plan, of 3 or 4 m. on the side. One of these has been broken into, exposing part of a grave formed of flat slabs of stone set on edge, with other slabs covering it. The inside of the grave is coated with white cement, while amongst the disturbed earth inside and around it were found fragments of a wooden coffin.

Finally, there remains to be noted a group of ruins about 2 kms. south of the citadel and town of Qurayyah, in the wadi bed upstream from the main site, and probably unconnected with it. These ruins comprise two stone circles, built of low dry walling, with adjacent stone cairns; they are similar to circles and cairns recorded at a number of other sites which will be discussed in the continuation of this report in a later issue of the *Bulletin*. Circle B on the plan (Fig. 10) was not investigated, but Circle A proved to be 55 m. in diameter, with two single upright stones in its centre, and an entrance gap in the wall on the west (Plate 38). Crossing the wadi just above these circles is a line of single large stones, each several metres from its neighbours, while another 2 kms. further upstream is another similar line. These lines of stones are quite different in appearance from the walls and dams of the main Qurayyah site, and it is unlikely that they served the same function or are of the same date. Their purpose remains obscure.

A great amount of surface material was collected from all over the area of the Qurayyah ruins, and a selection of this may be described briefly[48a]. From the two Nabataean buildings come a number of Roman and Nabataean sherds,

[48] *Land of Midian*, p. 180.

[48a] In common with all other material found during the course of the survey, the pottery from Qurayyah was deposited with the Department of Antiquities in Riyadh, and has not therefore been available for later study. The following discussion is based upon a necessarily somewhat superficial appraisal of the pottery in the field.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Note on Qurayyah pottery

The Qurayyah pottery was classified in the field into a number of distinctive wares, from A to N, and these designations are given in the lists accompanying the illustrations published here (Figs. 15–18). The categories are as follows:

Ware A	Coarse, reddish-buff or brown, sometimes with a grey core. Many large grits, red and black. Medium-hard fire.
Ware B	Medium coarse, pinkish-red. Moderate quantity of large grits. Hard fire.
Ware C	Metallic pinkish-red. Moderate quantity of large grits. Hard fire, sometimes overfired.
Ware C.1	Ditto, but with small grits.
Ware D	Pinkish-buff. Moderate quantity of fine grits. Hard fire.
Ware D.1	Ditto, but many coarse grits.
Ware E	Buff-white (cream).
Ware E.1	Grey-buff.
Ware F	Almost white, fine, smooth surface. Few grits, small to medium. Medium fire.
Ware G	Coarse metallic grey, sometimes with touch of red. Many large grits. Very hard fire, often overfired. Glaze-like surface.
Ware G.1	Fine grey. Many fine grits.
Ware H	Reddish-brown. Few fine grits. Hard fire.
Ware J	Coarse red, sometimes black core. Few small grits. Hard fire.
Ware J.1	Ditto, but many large grits.
Ware K	Red, sometimes black core. Few fine grits. Hard fire.
Ware L	Brown ware with black core. Many fine white grits. Hard fire.
Ware M	Very fine grey or red. Almost no grits. Hard fire.
Ware N	Rough light green to cream ware. Many fine grits. Hard fire. Surface completely sand-blasted.

Figure 15 Qurayyah Pottery. (Scale 1:5)

	Description	*Reg. No.*
1	Ware A. Pale brown paint on a white slip. Very worn surfaces.	Q.165
2	Ware A. Purplish-pink wash inside and upper third of outside. Black-brown decoration on yellowish-buff surface.	Q.23
3	Ware B. Black decoration on buff surface.	Q.24
4	Ware D. Dark grey surfaces inside and outside, mottled with buff (uneven firing).	Q.59
5	Ware D.1. Decoration in red, brown and black on light buff surfaces.	Q.84
6	Ware B. Buff surfaces inside and outside.	Q.34
7	Ware A. Dull purple-red outside; discoloured black decoration on dull red surface inside. Surface obscured by salt deposits.	Q.187
8	Ware A. Painted inside.	Q.135
9	Ware B. Plum red inside. Very faint traces of decoration outside in light red and black on buff surface.	Q.192
10	Description omitted in error.	Q.36A
11	Ware B. Black paint on red slip inside. Red slip outside. Coil built. Very irregular outside.	Q.28
12	Ware D. Inside surface dark grey.	Q.48
13	Ware D. Black decoration on light grey-buff surface.	Q.163

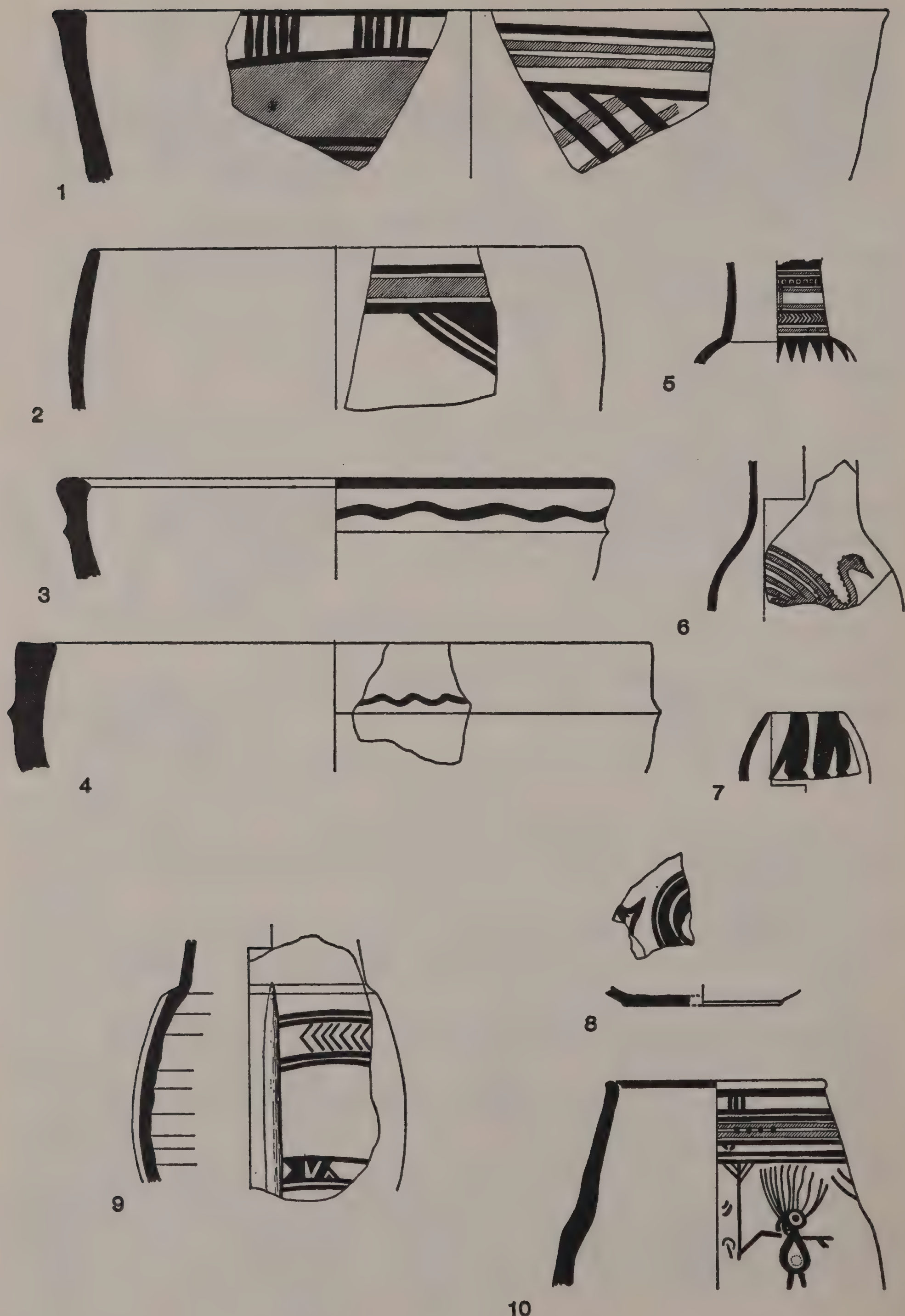
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Figure 16 Qurayyah Pottery. (Scale 1:5)

	Description	*Reg. No.*
1	Ware A. Black and dark red decoration on lighter red surfaces.	Q.27
2	Cream ware, black grits. Thick cream slip outside.	Q.202
3	Ware J.	Q.148
4	Ware J.1. Outer surface deep red, and very worn.	Q.149
5	Fine brick red ware, red wash inside. Outside, white cream slip painted dark brown and black.	Q.206
6	Ware B. Buff inside; orange outside.	Q.36
7	Fine pink ware, fine black grits. Black decoration on pale cream slip.	Q.199
8	Ware E. Buff surfaces.	Q.37
9	Ware D.1. Orange-brown streaky surface inside. Grey-brown outside.	Q.196
10	Ware B. Red surfaces inside and outside. Black decoration.	Q.31

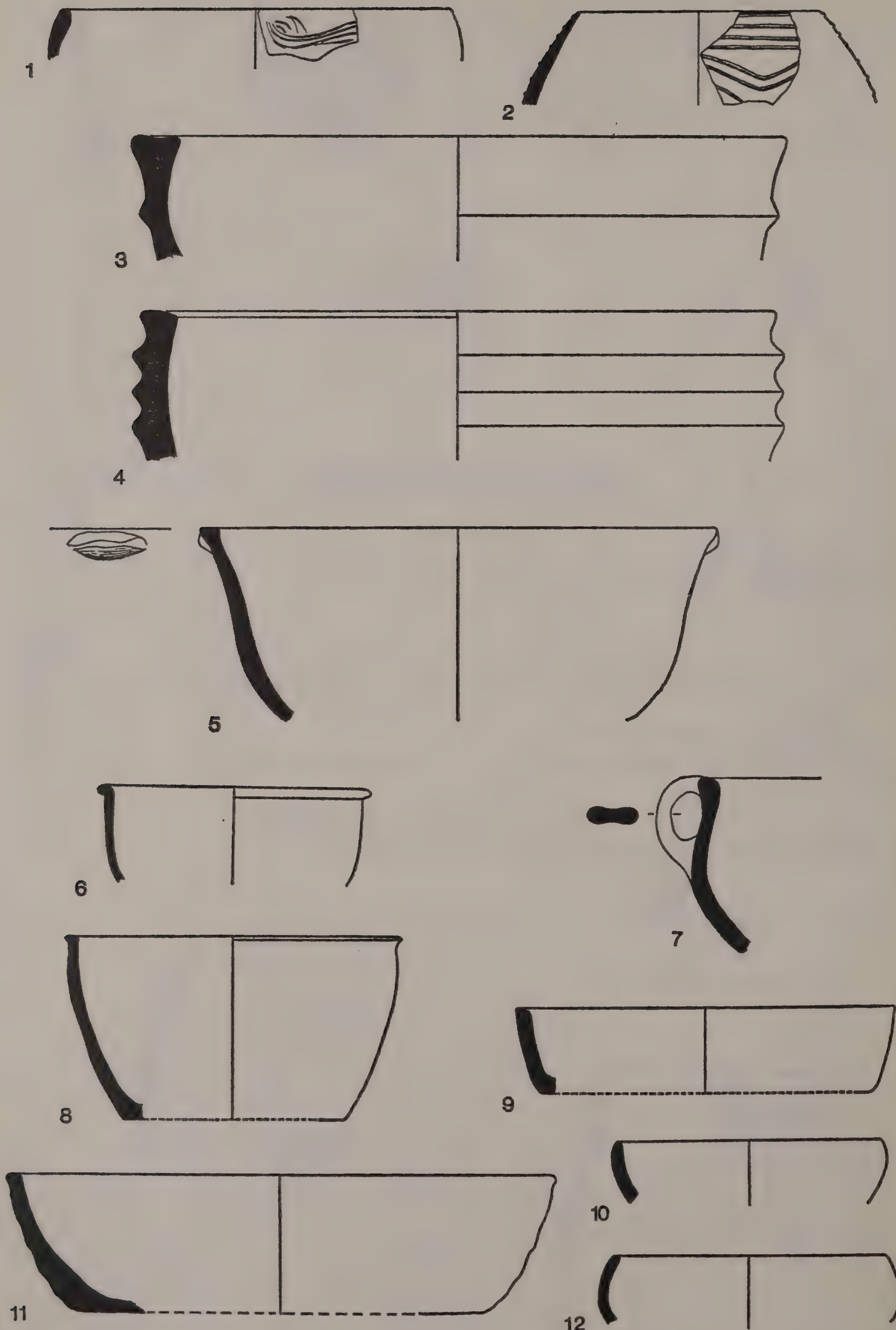
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Figure 17 Qurayyah Pottery. (Scale 1:5)

	Description	*Reg. No.*
1	Ware N.	Q.194
2	Coarse buff ware, large grits. Red wash inside and outside with barbotine decoration in white.	Q.198
3	Ware E.1. Black surfaces inside and outside, mottled brown in places.	Q.26
4	Ware A. Deep purple-red surface outside, dark grey inside.	Q.80
5	Ware C. Purple inside, black outside.	Q.60
6	Ware D. Grey surface outside, mottled orange and grey inside.	Q.6
7	Ware B. Purple surface inside. Outside very worn.	Q.52
8	Ware C. Dark grey surface outside, grey and red inside. Coil made.	Q.61
9	Ware B. Brown-grey slip. Firing uneven. Outside surface very worn.	Q.51
10	Ware G. Grey surfaces inside and outside.	Q.62
11	Ware A. Very roughly coil made.	Q.166
12	Ware B. Red slip inside and outside.	Q.57

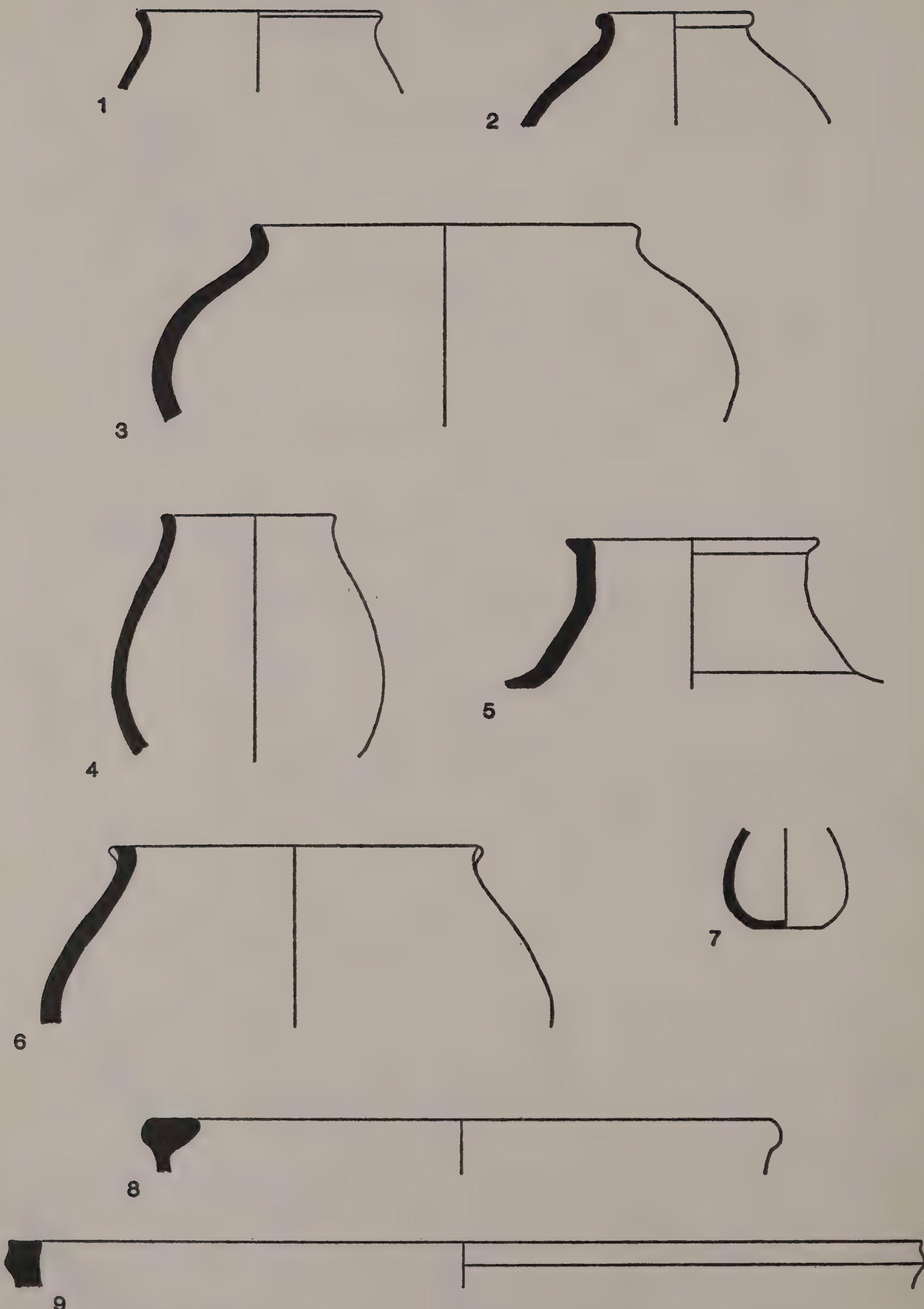
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Figure 18 Qurayyah Pottery. (Scale 1:5)

	Description	*Reg. No.*
1	Ware A. Dark red slip outside. Very worn. Pale red inside.	Q.8
2	Red ware, with black core. Black paint or slip outside.	Q.204
3	Ware A. Red-purple slip or wash inside and outside. Coil built, with ridges on outside and inside.	Q.29
4	Ware B. Orange surface inside, black outside.	Q.16
5	Ware A. Inside surface purplish, outside black.	Q.13
6	Ware B. Coarse, coil made. Rough red slip or wash inside and outside.	Q.54
7	Coarse red-buff ware, black grits, fine red slip inside and outside. Hand-made (possibly wheel finished).	Q.200
8	Ware A. Red surfaces inside and outside.	Q.97
9	Ware G. Semi-vitrified.	Q.181

as well as two fragments of steatite bowls (from Building II) and some small pieces of glass. A little material of the same nature and date was found scattered over the town site, and this also produced an unidentifiable bronze coin.[49] However, this Romano-Nabataean material stood out conspicuously from the rest of the surface pottery, which was found all over the town site, the citadel, and elsewhere in the neighbourhood of the enclosure walls and fields. Even making allowance for the subjectivity and unreliability of surface collecting, the most striking fact about this pottery is its homogeneity. The majority of it consists of coarse or medium wares, varying in colour from light red, through pink and buff, to cream, and characterized by the presence of large grits, often darker than the clay itself. Exceptionally, some pieces were of a finer cream paste with few grits. The majority of the vessels were wheel made, though some coil and hand built examples were noted. The most common shapes were platters and bowls, the latter often with a 'cyma' profile, although other shapes were naturally found. The undecorated vessels were usually covered with a thick slip, of a darker colour than the fabric. The most remarkable and distinctive feature is the painted decoration, however. This is typically applied in various tones of black, brown, red or yellow, on a thick buff or cream slip. Sometimes two colours are used, making a bi-chrome style. The designs are both naturalistic and geometric, and animals, birds, spirals, cross-hatching and festoons figure largely. The published examples of this pottery (Figs. 15, 16, 17, and 18 and Plate 42) illustrate its nature better than can any words, and will suffice until a more thorough analysis of the material is made.

In view of the clear association of this painted pottery with the major ruins of Qurayyah—citadel, town, and field enclosures—the question of its date is of the utmost importance. Its decoration is immediately reminiscent of that on various painted fabrics in the Levant during the Late Bronze Age, and although comparative study reveals few close analogies, to include shape, decoration, and ware, the resemblances are strong enough to make it certain that the Qurayyah pottery belongs to this general chronological horizon. The only published material directly comparable with the Arabian pottery comes from sites just over the frontier, in southern Jordan and Palestine. Of these, Tell el-Kheleifeh and Timna, both in the southern Arabah, are the most important, having produced a certain amount of pottery which is identical with that from Qurayyah.[50] The dating of this Arabah painted ware—sometimes called Edomite ware—is in dispute; the excavators of Timna have recently suggested a date in the twelfth or eleventh century,[51] while Glueck has argued for a lower

[49] Moritz also found a few unrecognizable coins here, together with two triple-edged bronze arrowheads and a flint arrowhead (Moritz, *op. cit.*, p. 404).

[50] For Kheleifeh, *cf.* N. Glueck *B.A.S.O.R.* 188 (December 1967), p. 8 ff., fig. 1, no. 2; and fig. 4, nos. 3–5. For Timna, *ibid*, fig. 1, no. 1, and Rothenberg, *Révue Biblique*, LXXIV (1967), pp. 83–85 and plate XI.

[51] B. Rothenberg, *op. cit.*

date, in the seventh to sixth centuries.[52] As these words are being written, however, there are reports of the discovery of this same painted pottery in association with a thirteenth to twelfth century Egyptian temple at Timna, and a date as high as this would be by no means impossible, in the light of one or two other pieces of comparative material, which may now be mentioned. Of these, the first is a painted jug from Tomb 1099 at Tell Ajjul, in what Petrie calls 'a strange style, unique in this place'.[53] The decoration can be matched on several of the Qurayyah sherds, while inspection of the jug in the Palestine Archaeological Museum by one of the writers (J. E. D.) reveals that its fabric is also very similar. Tomb 1099 contained also a Base Ring II jug and a pilgrim flask, and appears to be a good LB group, though the excavator noted that the burial had been disturbed.

Another site excavated by Petrie furnishes evidence pointing to a slightly different date. From the Residency at Tell Fara come three sherds (now at the Institute of Archaeology) which are singled out in the publication as being distinctive and 'no doubt foreign to the district'.[54] They are extremely close—though probably not absolutely identical—to certain of the finer Qurayyah sherds, in both ware and painting. According to the information available they come from on or above the courtyard of the Residency, and were found with Philistine pottery. They are presumably of the twelfth century, therefore, a date which agrees with that of the Timna material. But, interesting though these analogies are, cautious scholars will avoid being too dogmatic in their estimation of the precise dating of the Qurayyah painted pottery until it has been subjected to closer study, and until more of the Arabah material is published. It is enough for the present writers to reiterate their belief that it is basically a Late Bronze Age fabric, and must be dated to the final centuries of the second millennium B.C.

A few more words need to be said on the subject of the distribution of this painted pottery. Apart from at Timna and Kheleifeh, this very distinctive ware is found, according to Rothenberg, nowhere else in the Arabah, the Negev, or Sinai, except at Jazirat Fara'un and at a small site on the southern shores of the Dead Sea.[55] East of the Arabah one sherd has been noted—unfortunately in an unsealed group—at Tawilan, near Petra,[56] and it must be stressed, in this connection, that the bulk of the material published by Glueck from his surveys of this area as 'Edomite' pottery is of an entirely different nature and date. Finally,

[52] N. Glueck, *op. cit.*, p. 10.

[53] *Ancient Gaza II* (1932), p. 12, and plate XLI, no. 42.

[54] J. L. Starkey and G. L. Harding, *Beth-Pelet II: The Cemetery* (1932), p. 29 and plate LXIII, nos. 53–55.

[55] Personal communication.

[56] We are indebted to Mrs. Crystal Bennett for permission to mention this unpublished material. (Since this was written the writers' attention has been drawn to the presence of a few sherds of Qurayyah type amongst the material excavated by Dr. J. B. Hennessy from the L. B. temple at Amman. We are indebted to Dr. Hennessy and Mrs. V. Hankey for discussing this material with us).

there is, as we have seen, a small amount of comparable, though probably not strictly identical, material at Ajjul and Fara. At all of these sites, however, the pottery has the appearance of being a foreign, or at least a minority, fabric; even at Timna and Kheleifeh it forms only a part of the total contemporary ceramic assemblage, being found side by side with more usual Palestinian material. At Qurayyah, on the other hand, the painted ware and the related plain ware is so abundant as to prove beyond all doubt that it is the local and common pottery. It is even highly probable that the site of the kilns which produced it at Qurayyah can be identified; at the foot of the citadel cliff, between Walls C and D (see plan, Fig. 11) is an area of heavy burning with a thick scatter of vitrified pottery, burnt clay, and clinker, and unmistakable indications of at least one oven (Plate 39). The only identifiable sherds from here were of the decorated type we have been discussing. A little farther to the east, on the other side of Wall D, a great pile of débris and sherds, apparently derived from the summit of the citadel, illustrates the amount of this pottery in use at Qurayyah (Plate 40).

As for the rest of the N.W. Arabian region, it is true that Qurayyah is the only place so far where this pottery has been indisputably found. However, in the store-rooms of the Riyadh museum there are bags of this same ware which are said to come from Tayma,[57] while one other possibly identical sherd was picked up by the present expedition at Mugha'ir Shu'ayb. Moreover, it should be remembered that Qurayyah is not an isolated site; Philby has reported sites with similar architecture and fields in the same neighbourhood, and it is perhaps not unreasonable to suppose that these will also be found to be characterized by the painted pottery we have been discussing. If this is so, then we may well be forced to conclude that N.W. Arabia—Midian and the Hejaz—is the true home of this fabric, and that its sporadic appearance farther north, in Palestine and Jordan, is an indication of Arabian penetration there. Whether, and in what precise manner, this penetration is to be linked with the history of the Midianites of the literary sources, is a problem which cannot be pursued here. It can at least be suggested, however, that the term 'Midianite' seems the most appropriate at the moment for the Qurayyah-Timna painted pottery.

Important though this pottery is, it is the architectural and especially the irrigational remains at Qurayyah which make it a site of outstanding significance. These are imposing by any standard, and testify to the high level of material culture in N.W. Arabia in the late second millennium. A comparative study must await further research, but it may be said at once that the field system and associated water works are—if our dating of them is correct—amongst the earliest known from the entire area of Arabia and the Levant. Of recent years much attention has been paid to the ancient farming of the Negev of Palestine,

[57] Our thanks are due to Mr. Hadlak and Mr. Ayyash for showing us this pottery. (Some sherds of this painted ware from Tayma have now been published by Reed and Winnett; see fn. 2, above).

and it is generally accepted that the earliest irrigation systems here date from about the tenth century B.C.[58] At the other end of the Peninsula, two thousand kilometers away in the Yemen and Aden, vestiges of agriculture and irrigation very similar to those of Qurayyah have been shown to date from at least the beginning of the first millennium, and Bowen has suggested that they originated several centuries earlier than this.[59] The Qurayyah remains are as old, therefore, as their South Arabian counterparts, and older than those of the Negev. Much more study is required before it can be shown how these comparable agricultural systems at opposite ends of the Arabian Peninsula are related, but it may be remembered that Van Beek has argued recently for a very significant Levantine content in South Arabian civilisation,[60] and it may well be that it was in the north, at settlements such as Qurayyah, that the traders of Qataban and Saba learned their skills in irrigation farming which enabled them, from *c.* 1000 B.C. onwards, to develop their amazingly rich culture.

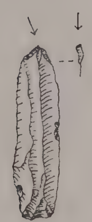

Figure 19 Qurayyah. Flint burin.

Fine-grained banded brown flint. Very delicate, made at tip of small blade, with retouch extending only across end of blade to burin edge. Edges and butt of blade abraded by use. (½)

The history of Qurayyah may extend even farther back than the second millennium. A single flint burin (Fig. 19), picked up from the surface of the fields, is typologically Neolithic[61]. Judging from its appearance it has not travelled far, and it probably testifies to some sort of human habitation at the site as early as the fifth or sixth millennium. It serves as a final indication of the rich archaeological potential, still almost wholly unexploited, of N.W. Arabia.

[58] See, for example, Y. Aharoni, 'The Negeb', in *Archaeology and Old Testament Study* (ed. Winton Thomas) 1968, p. 391.

[59] R. Le Baron Bowen and F. P. Albright, *Archaeological Discoveries in South Arabia* (1958), pp. 67 and 87.

[60] Gus W. Van Beek, *Hajar Bin Humeid* (1969), pp. 356, 367, etc.

[61] We are indebted to Mrs. Joan Payne and Mrs. Ingrid Azouri for help in identifying and illustrating this object.

APPENDIX:

A Note on the Epigraphy (*by* G. Lankester Harding)

In the brief time available in the Hejaz it was not possible to get more than a glimpse of the immense richness of epigraphic material which is known to be there; in al-'Ula and Meda'in Salih, furthermore, heavy rains almost every afternoon were an added difficulty. But it is surely significant that, though only familiar territory was traversed, two important new groups of material were found, one of early Thamudic texts at Mantar Bani 'Atiya near Tayma, the other of Lihyanite texts in the wadi Mu'tadil at Khuraybah, as well as two new Minaean texts from the same site. In addition, a new Greek text (forming part of the well-known bilingual dedication) was found at Rawwafah, and from here and various other sites came several new Nabataean graffiti. A total of ninety-six texts were recorded, of which eighteen have already been published elsewhere.

From a very brief examination of a small group of graffiti and funerary texts at Khuraybah, it is clear that a certain amount of deterioration has taken place since they were recorded by Jaussen and Savignac in 1907. For this reason, and also because there is so great a difference among scholars in reading and interpreting graffiti and texts of which only hand-copies have been published, the most urgent need is now for a complete photographic and hand-copy record of all known inscriptions and any new ones that might come to light in the process. Such copies of graffiti as those made, for example, by Philby, are useless, and often worse than useless in that they are definitely misleading owing to the way they have been split up by the copier. The argument that any kind of record of a text is better than none is a completely falacious one, at least so far as any reading or basing of theories regarding paleography are concerned. Even Jaussen and Savignac sometimes split up a text, and none of the graffiti they publish shows one text in relation to the other, an essential feature of any collection of this kind if anyone is to be able to check readings. Particularly do these remarks apply to the Thamudic graffiti, and any further studies of these based on presently available publications are really a waste of time.

Plate 1 Maʿabiyat. East wall of Ruins B

Plate 2 Maʿabiyat. Surviving brick wall

Plate 3 Ma'abiyat. General view of north end of site'

Plate 4 Qurayyah. View of town site from citadel

Plate 5 Qal'at al-Badayi'

Plate 6 Al-'Ula. Valley and gardens, from south

Plate 7 Khuraybah. General view of *khirbah*

Plate 8 Khuraybah. Ruins partly destroyed by railway cutting

Plate 9 Khuraybah. Wall or dam across Wadi Mu'tadil

Plate 10 Al-'Ula museum. Statue 1 (front)

Plate 11 Al-'Ula museum. Statue 1 (back). (scale 30 cms. long)

Plate 12 Al'Ula museum. Statue 2. (scale 30 cms. long)

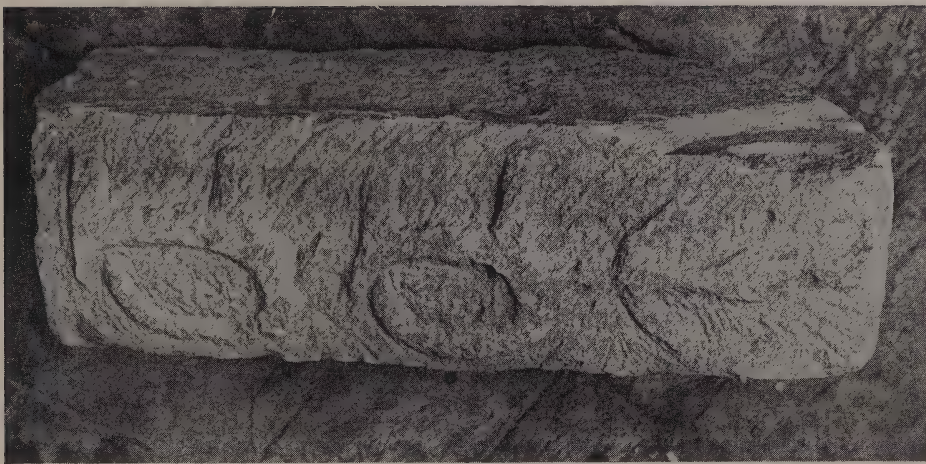

Plate 13 Al-‘Ula museum. Frieze of ibexes

Plate 14 Rawwafah temple from south-west

Plate 15 Rawwafah. Room in north-west corner, showing entrance

Plate 16 Rawwafah. Masonry at south-west corner

Plate 17 Rawwafah. Lintel with bilingual inscription

Plate 18 Rawwafah. Greek inscription on angle pilaster capital

Plate 19 Rawwafah. Fragment of moulding

Plate 20 Rawwafah. Re-used stone with inscription (not visible in the photograph) on flat surface

Plate 21 Qurayyah. Citadel hill from north

Plate 22 Qurayyah. Walls on summit of citadel, from west

Plate 23 Qurayyah. Detail of construction of summit wall

Plate 24 Qurayyah. Tower on western wall of summit

Plate 25 Qurayyah. Interior of structure on citadel

Plate 26 Qurayyah. Tower at eastern end of citadel

Plate 27 Qurayyah. Wall H

Plate 28 Qurayyah. Detail of Wall G

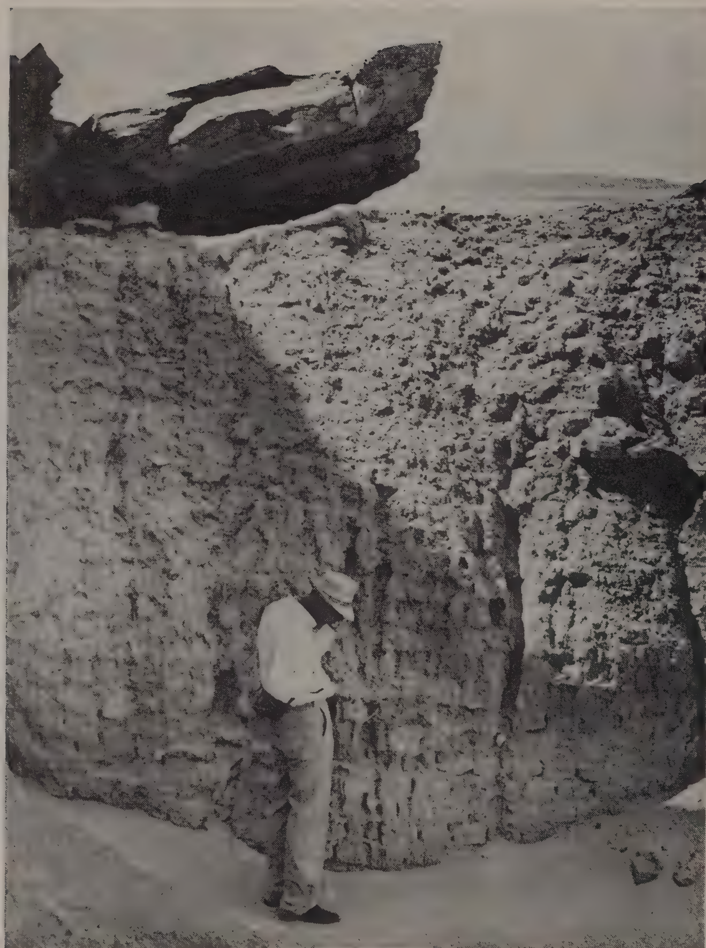

Plate 29 Qurayyah. Mud-brick section of Wall D

Plate 30 Qurayyah. Irrigation channel in field area

Plate 31 Qurayyah. General view of fields

Plate 32 Qurayyah. Field walls

Plate 33 Qurayyah. Nabataean Building I from the south-west

Plate 34 Qurayyah. Nabataean Building I showing style of masonry

Plate 35 Qurayyah. Fragment of Nabataean capital from Nabataean Building I. (scale in cms.)

Plate 36 Qurayyah. Column base and drums in Nabataean Building I. (Scale 30 cms long)

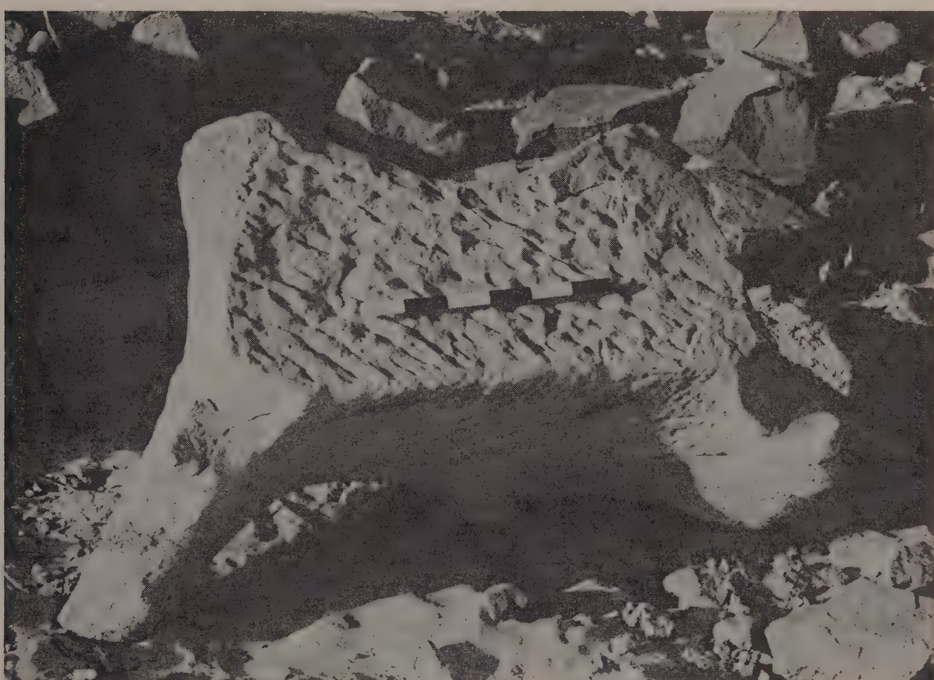

Plate 37 Qurayyah. Nabataean capital from Nabataean Building II. (Scale 30 cms long)

Plate 38 Qurayyah. Stone circle A

Plate 39 Qurayyah. Remains of kiln. (Scale 30 cms. long)

Plate 40 Qurayyah. Pottery dump at eastern foot of citadel

Plate 41 Khuraybah. Typical painted sherds. (Scale approx. 1:2)

Plate 42 Qurayyah. Selection of painted sherds

The Arabia Society

During the early part of 1968 an informal study-group was set up (at the suggestion of Mr. John E. Dayton and after consultation with Dr. R. D. Barnett, Professor D. J. Wiseman and Mr. P. J. Parr) to promote the cause of archaeological research in the Arabian Peninsula. An inaugural dinner was held in the House of Lords on 4th April under the chairmanship of Lord Teynham, when the guest of honour was Counsellor Muhammad Nuri Ibrahim of the Saudi Arabian Embassy. The group has now formed itself into a Society, and is registered as a charity. The Honorary Secretary is Mr. Dayton and Professor Grimes has kindly permitted the Society to use the Institute of Archaeology as its address.

The second meeting was held on 7th October, 1968, when Mr. Parr gave an illustrated talk on the preliminary survey of the Northern Hejaz which he and Mr. Dayton had recently carried out under the auspices of the Institute of Archaeology.

On 6th January, 1969, a one-day seminar was held at the Institute, and a number of papers, summarized below, were read and discussed.

EARLY CONNECTIONS BETWEEN SUMER AND EGYPT

by Miss M. S. Drower

Evidence for contact between Mesopotamia and Egypt in the late predynastic period and contemporary with the beginning of the first dynasty in Egypt has been extensively studied and discussed, notably by Scharff, Frankfort and Miss Kantor, and has been recently summarized in the new edition of the Cambridge Ancient History both by Mrs. Baumgärtel and in Frankfort's posthumous chapter.

The nature of the evidence is three-fold:

(1) Objects of certain Mesopotamian origin and those directly copied from Sumerian artefacts.

(2) The appearance in Egypt of techniques which were known in Mesopotamia at an earlier date, and presumably, therefore, transmitted from the one country to the other.

(3) Motifs of decoration which are untypical or unique in Egypt, and may be assumed to be Sumerian.

In the first category, the most convincing evidence has been furnished by the presence in Egypt of Jemdet Nasr cylinder seals, and by the comparatively frequent occurrence of lapis-lazuli beads and amulets in Gerzean graves. The sole source of lapis is thought to be Badakhshan. Mrs. Herrmann has shown recently that after the Jemdet Nasr period there was a break in the supply to Mesopotamia; a corresponding break in Egypt after the Gerzean period has been noted by Mrs. Payne. A few other small stone objects, all portable, and the use of pear-shaped mace-heads in quantity are less convincingly suggested as evidence of connection with the Euphrates valley. In the category of techniques, the idea of writing appears to have spread from the centre of its early invention in Mesopotamia but it has been pointed out that although a similar system was employed in both countries, the actual pictograms in the early Sumerian tablets and the hieroglyphs of the earliest ivory tablets have almost nothing in common. Similarities in early architectural forms in the two countries are more striking and the parallels between the recessed brick façades of the palaces of the first dynasty in Egypt and the temple façades on Sumerian cylinder seals, studied by Frankfort[1], are very striking. He concluded 'there can be no reasonable doubt that the earliest monumental brick architecture (in Egypt) was inspired by that of Mesopotamia, where it had a long previous history'.

Several motifs in decorative art common to both countries at this period show striking similarity, e.g. fabulous monsters such as felines with intertwined snake-necks. On one side of the unique ivory knife handle from Gebel-el-Araq, the hero grappling with lions is familiar from Sumerian art but not from Egyptian. His costume is reminiscent of Elamite rather than Egyptian dress, and the heavily-maned lions are not of African type. On the reverse of the handle, an engagement is depicted between two different kinds of ships, one of curved Egyptian type—the typical 'sickle-boat' of the Gerzean pots—the other flat-bottomed, with high, steeply-curved prow and stern. Boats similar to these are found in rock drawings in the eastern desert of Egypt along the Wady Hammamat, on the ancient route from the Nile valley at Coptos to the Red Sea port of Qoseir. H. A. Winkler, who discovered these drawings, regarded them as representing the boats of invaders from the east.

Granted that there were contacts between Mesopotamia and Egypt, the problem must be to decide by what route they travelled. Could there have been an overland link, presumably through North Syria either to Byblos and thence by sea, or via Palestine? There are, it is true, some links between Palestine and Egypt in the Gerzean period and cylinder seals of Jemdet Nasr type have been

[1] Frankfort, *AJSLL* (1941).

found in northern Syria, but there is no evidence of a knowledge of writing either in Syria or Palestine. By this theory, too, the 'square boats' of the eastern desert of Egypt remain unexplained.

The possibility of a sea route linking the head of the Persian Gulf with the western shore of the Red Sea must now be considered. The question is one of navigation and sea-worthiness. Could these small ships have sailed the 4,000-odd miles between Eridu, at the head of the Persian Gulf, and Qoseir at the end of the Wady Hammamat? Some scholars have emphasized the impossibility of a voyage of such length, arguing the scarcity of anchorages along the South Arabian cost, the danger from coral reefs near the shores of the Red Sea and the difficulties of navigation through the treacherous currents of the Bab-el-Mandeb. But it is by no means certain that the boats were small: one of Winkler's pictures shows a crew of 32. By the fourth dynasty, Egyptians were already building ocean-going sailing ships 120 feet long. Sails are not depicted on Winkler's 'square boats' but are found early in Egypt and although there is no early Sumerian representation of a boat with sail up, the well-known boat model from Eridu has holes for a mast and stays. Quite small Arab dhows nowadays make the journey between Arabia and India with ease.

Granted that ocean-worthy boats could have been built by pre-dynastic man, could he have navigated so far? I do not think that this is impossible, with the many navigational aids at his command. Herodotus mentions sounding by lead and line, and the Ancient Egyptians, who used knotted ropes for the measurement of fields, would certainly have been able to take soundings to avoid coral reefs and sandbanks. Anyone who ventures into the Indian Ocean soon learns the régime of the alternating monsoons (from October to March the winds blow from the N.E., from May to September, from the S.W.). The south coast of Arabia is roughly aligned with these winds, enabling dhows to make the return journey from Africa to India and back every year. Ancient ships would probably hug the coastline as much as possible and ride at anchor or beach at nightfall. The author of the Periplus of the Erythraean Sea describes just such voyages, and Arrian in his narration of the voyage of Nearchus from the Indus to the head of the Persian Gulf says that his fleet hugged the coast, landing at night and travelling by day only.

A few years ago, Dr. Dales discovered forts of the Harappan civilization on the coast of Makran which were probably staging posts on the route from the Harappan port of Lothal at the mouth of the Indus to the head of the Persian Gulf. Perhaps we should look for similar fortified trading-posts along the South Arabian coast. It is even conceivable that ancient boats could travel in the open ocean by night, steering by the stars as Odysseus did. Arab sailing manuals of the fifteenth century describe how a ship's position can be established by measuring the height of a star above the horizon by so many 'fingers' (held horizontally at arm's length and at eye level).

The problem of the identification of the lands Magan and Melukhkha is pertinent to our enquiry, though I do not wish to anticipate Dr. Sollberger's paper. In the belief of many, both lay beyond the Persian Gulf. If Magan was the coast of Makran or of Oman, and Melukhkha the Indus Valley region, as has been argued, then voyages into the Indian Ocean were made by Sumerian sailors at least as early as the Akkadian period. But Magan and Melukhkha in Assyrian texts of the first millennium, and even as early as the Amarna period, meant Egypt and Nubia, and it is at least conceivable, as Jacobsen has argued, that the east coast of Africa was from the very beginning the goal of these sea voyages.

Finally, four questions:

(a) Why was traffic between Sumer and Egypt, as far as we know, entirely one-sided? It is remarkable how few Egyptian objects of any date have been found in Mesopotamia. Could the Sumerians have brought back perishable objects only?

(b) What connection is there between these early voyages, if they took place, and the incense trade?

(c) Should we abandon the idea of direct contact by sea and postulate rather an indirect connection with some people or peoples on the south coast of Arabia, acting as middlemen?

(d) Why did the contact cease after the unification of Egypt?
Perhaps this is the most difficult question of all.

DISCUSSION

Professor Lloyd pointed out that there were two fixed points around which the route of Egyptian and Sumerian contacts might be traced (a) the recent finds in Buraimi oasis, (b) the Babbar Temple site in Bahrain.

Miss Tufnell drew attention to the land route via Palestine. The recent finds of Proto-dynastic material by Professor Yeivin at Tell-el-Oreimi showed Egyptian occupation. On the other hand, the enormous distance from the coast of Iraq to Wadi Hammamat in Egypt, through which some people argued contact was made, was not as great as that travelled by pottery found in S. America originating in Japan.

Mr. Dayton suggested that there might be a route from Sumer running across the Arabian desert from E. to W. to Wejj (the ancient Leuke Come) then across the Red Sea.

Dr. Isserlin asked that the investigation of this idea might be made a project. He also asked if there was any change in sea and water levels since ancient times in those parts.

Dr. Sollberger drew attention to two further points of contact between Egypt and Mesopotamia.

(1) Adzes of an Egyptian XVIIIth dynasty type are represented in Old-Babylonian terracotta plaques.

(2) An Egyptian pre-dynastic palette in the British Museum contains a scene strikingly similar to the famous Nimrud ivory of the Negro devoured by a lioness.

THE PROBLEM OF MAGAN AND MELUHHA

by EDMOND SOLLBERGER

(1) It is fairly certain that in the first millennium the toponyms Magan and Meluhha correspond to Egypt and Nubia and/or Ethiopia. It is, however, doubtful that this was so in earlier periods as well. In fact the problem of the geographical areas covered by the terms Magan and Meluhha in the third and second millennia is still an open question, although several identifications have been proposed by various scholars, e.g.:

(a) *Jacobsen:* Magan=Egypt; Meluhha=Ethiopia.[1]
(b) *Falkenstein:* Magan=possibly Egypt; Meluhha=possibly India.[2]
(c) *Weidner:* both in Oman, Magan from Ru'us el Jebal to Qatar; Meluhha from S.E. Oman to Ras el Hadd.[3]
(d) *Kramer:* Magan and Meluhha both in Nile countries.[4]
(e) *Landsberger:* both in the Persian Gulf area.[5]
(f) *Oppenheim:* Magan and Meluhha possibly in India.[6]
(g) *Forrer:* Meluhha=Indus Valley and Baluchistan.[7]
(h) *Gershevitch:* Magan in the Persian Gulf area (see below, (iv)(b)).[8]
(i) *Gadd:* Magan on the shores of the Gulf of Oman (=Makran); Meluhha included the upstream cities of the Indus.[9]

[1] *Iraq* 22 (1960), p. 184, fn. 18

[2] A. Falkenstein & W. von Soden, *Sumerische und Akkadische Hymnen und Gebete* (1953), pp. 415 f. More recently, in *Analecta Orientalia* 30 (1966), pp. 48 f., Falkenstein suggested as a possible identification of Magan either Weidner's ((1) (c) below) or Gadd's ((1) (i) below), and favoured Western India for Meluhha

[3] *Archiv für Orientforschung* 16 (1952), pp. 6 ff.

[4] *The Sumerians* (1963), pp. 277 ff.

[5] *Zeitschrift für Assyriologie* 35 (1924), p. 217

[6] *Journal of the American Oriental Society* 74 (1954), p. 16

[7] *Forschungen* 5 (1947), p. 39

[8] *Bulletin S.O.A.S.* 19 (1959), pp. 317 ff.

[9] *C.A.H.*, rev. ed., Vol. I, Chapter XIX (1963), pp. 25 f.

(j) *Mallowan:* Magan=Iranian coast of the Persian Gulf; Meluhha=S. Iran, N.W. Pakistan and S. Afghanistan.[10]

(2) In my opinion, none of the above identifications is convincing enough to be accepted without any reservation. Let us examine briefly the information on Magan and Meluhha yielded by cuneiform texts.

(i) *Old-Akkadian Dynasty*

(A) *Sargon:*

(a) Tells of boats of Magan and Meluhha (and Tilmun) moored in Akkad harbour.[11]

(b) Mentions the bridge of Baza (in N.E. Arabia) 'which is at the border of the road to Meluhha'.[12]

(c) Gives as 120 *beru* (about 800 miles) the distance from the weir of the Euphrates to the border of Meluhha.[13] Even if one accepts Albright's altogether plausible location of that weir at Deir ez-Zor,[14] Sargon's information is not as useful as it may sound since he gives us neither the nature nor the direction of the route.

(B) *Manishtushu:* Claims victory over Anshan and Sherihum, both in Elam, but a variant text gives the pair as 'Anshan and the city of Meluhha'.[15] (See below, (iv)(d)).

(C) *Naram-Sin:*

(a) Alabaster vases inscribed as 'booty of Magan'.[16]

(b) Victory over Manuim, king of Magan.[17] A hasty identification of Manium with Menes has led to an argument in favour of the equation Magan =Egypt.[18]

(D) A cylinder seal[19] of Shu-ilishu, the 'dragoman of Meluhha' proves beyond any doubt that Meluhha was not only 'abroad' but had its own language and was not part of the Mesopotamian linguistic empire.

(ii) *Guti period: Gudea:*

(a) Imports 'diorite' from Magan; wood from Magan and Meluhha; gold-dust, silver, copper, tin, carnelian, and lapis-lazuli from Meluhha.[20]

[10] *Iran* 3 (1965) pp. 1 ff.

[11] *H. Hirsch, Archiv für Orientforschung* 20 (1963), pp. 37 f.

[12] At the beginning of the famous text, VAT 8006, describing Sargon's Empire: Weidner, *Archiv für Orientforschung* 16 (1952) p. 4

[13] *Ibid*, p. 5. line 30

[14] *Journal of the American Oriental Society* 45 (1925), p. 230

[15] H. Hirsch, *op. cit.*, p. 69; Sollberger, *Jaarbericht Ex Oriente Lux* 20 (1967–68), pp. 63, 65, 67

[16] Thureau-Dangin, *Die sumerischen und akkadischen Königsinschriften* (1907) pp. 164, 2c

[17] *Op. cit.* p. 166, h, ii 3 ff.

[18] Albright, *Journal of Egyptian Archaeology* 6 (1920), pp. 89 ff., 7 (1921) pp. 80 ff.; Ungnad, *Archiv für Orientforschung* 14 (1941–44), pp. 199 ff.

[19] *Collection De Clercq, Catalogue . . .*, Vol. I (1888), pl IX, 83

[20] *Passim* in the text of the Statutes (Thureau-Dangin, *op. cit.*, pp. 67 ff.) and Cylinders (*ibid.*, pp. 89 ff.)

(b) Refers to Meluhha as *kur*, which can mean 'mountain' or 'land' (and also 'foreign land'); and to Magan as *kur* and (once) as *hursag*,[21] which can only mean 'mountain'.

(iii) *Third Dynasty of Ur: Ibbi-Sin* receives as tribute a 'red (or perhaps "spotted") dog of Meluhha'.[22]

(iv) *Lexical and administrative* as well as *literary texts* show that:

(a) Magan and Meluhha were famous for dates distinctive enough to be known as 'Magan dates' and 'Meluhha dates'.

(b) Each produced a certain species of *mes*-wood: that of Magan, called 'mes of Magan' in Sumerian and *musukannu* in Akkadian, has been identified as Dalbergia sissoo by Gershevitch (see above, (1)(h)).

(c) A certain bird was called in Sumerian the 'francolin (*dar*) of Meluhha' and in Akkadian the 'little black (bird)'. It has sometimes been identified as the pea-cock,[23] obviously on the assumption that Meluhha=India. (The Chicago *Assyrian Dictionary*'s translation of the Sumerian term as 'Ethiopian *dar* bird'[24] rests on a similar assumption).

(d) A proverb[25] mentions the 'donkey of Anshan' and the 'cat of Meluhha' (for the same pairing see above (2)(i)(B)).

(e) In the Sumerian poem, 'Enki and the World Order',[26] in which blessings are bestowed on various lands, Meluhha comes immediately after Sumer and Ur, before a group of various foreign lands (Tilmun, Elam, Marhashi, Martu), the Tigris-Euphrates region, the Marshes, and the Sea. Meluhha is called the 'black country' (note that in later times Esarhaddon refers to the 'black Meluhhans'), but this can hardly be adduced to project the equation Meluhha=Nubia and/or Ethiopia into the early periods. After all the Sumerians' referring to themselves as the 'black-headed people' does not necessarily make them Negroes; besides, the phrase 'black country' may well denote physical or environmental, rather than ethnic, features (cf., e.g. England's 'Black Country').

(3) To sum up: Magan and Meluhha must be sought in a region near enough to Mesopotamia to allow military expeditions and sustained trade relations; with easy access to the sea (or at least to fluvial ports); and producing a certain number of characteristic plants, animals, woods, and minerals. It should of course be stressed that a country may be famous for a certain product not for producing it but simply for marketing it (London and the tea trade is a case in point).

21 *Statue D* iv 15.
22 Sollberger, *Ur Excavations, Texts* 8 (1965), pp. 8 f., No. 37
23 Leemans, *Foreign Trade in the Old Babylonian Period* (1960), p. 166; Falkenstein, *Analecta Orientalia* 30 (1966), p. 49, fn.2
24 Vol. 16 (1962), f. 238, s.v. *ṣulāmu*
25 Lambert, *Babylonian Wisdom Literature* (1960) pp. 272 f.
26 Bernhardt & Kramer, *Wissentschaftliche Zeitschrift der Friedrich-Schiller-Universität Jena* 9 (1959–60), pp. 231 ff.; Falkenstein, *Zeitschrift für Assyriologie* 56 (1964), pp. 44 ff.

DISCUSSION

Dr. Barnett commented on the connection between the stylized architectural façades to be seen on early Egyptian palettes, quoted by Miss Drower, and those seen on proto-dynastic Sumerian seals and also on South Arabian sculptured slabs. He also suggested that the fixed point of the regulator of the Euphrates mentioned in the texts about Meluhha must be the regulator S. of Falluja leading into the ancient Pallacottas canal.

Miss de Cardi said that Chinese records reported the existence of a region in the West called Malwa or Malhwa, which recalled Meluhha.

Dr. Sollberger pointed to the importance of lapis-lazuli as coming from Meluhha.

Miss Drower referred to inscribed alabaster vases, and asked whether they were in fact Egyptian, and pointed out that Gudea's statues were said to be made from diorite of Magan.

Miss Page pointed out that there was no word in Akkadian for 'turquoise'. Was it covered by the word *uqnu*?

Mr. Hawkins pointed out that lapis was carried from E. to N., or W.

Dr. Barnett referred to a boat-shaped vase in diorite(?) resembling vessels from the Royal Graves at Ur recently found accidentally in Oman.

Dr. Sollberger sounded a word of caution on the dangers of 'Klangetymologie'. He pointed to the importance of the information that metals and minerals, especially lapis-lazuli, were imported from Meluhha; and also that both Magan and Meluhha must be countries producing dates distinctive enough to be called Magan-dates and Meluhha-dates.

THE NABATAEANS AND NORTH-WEST ARABIA

by P. J. Parr

Despite the evident part played by Arabia in the history of the Nabataeans, both in the pre-sedentary and sedentary period, there is as yet very little archaeological evidence from Arabia proper to concern us. The two most important Nabataean sites there, Medain Salih and Mugheir Su'aib, are too poorly known to be of any great value, while the innumerable Nabataean inscriptions in the region are not very informative. The chronology and the pattern of Nabataean settlement in Arabia cannot yet be discerned. At Medain Salih the earliest sherds picked up from the surface are probably of the 1st century B.C., while the important rock-cut tombs, most of which have inscriptions, and which can all be dated to the 1st century A.D., show that by this time

Hellenistic artistic influences had become firmly implanted in the Hejaz. The only other known site of importance, Rawafa, is later still, and raises many problems. Here, an isolated temple is dedicated (according to a Nabataean/Greek bilingual text) to Marcus Aurelius and Lucius Verrus, *c.* 166–169 A.D. (The text has been published by Seyrig from a hand-copy of Philby in *Syria* 1957, and is to be re-published by Milik and Starcky, from photographs taken during a recent visit to the site by Harding, Dayton and Parr, in the new edition of the *C.I.S.*) We are, however, entitled to ask whether the Rawafa temple should, strictly speaking, be called a Nabataean monument at all, for despite the fact that the plan and various structural peculiarities are clearly Nabataean, while Nabataean is the language used for the Semitic texts, yet the monument was apparently built by a member of the Robath clan of the Thamudian tribe, and should for that reason perhaps be termed a Thamudian sanctuary. This connection between the Nabataeans and the Thamudians reminds us that in the Medain Salih inscriptions another tribe, the Shalamu, is often mentioned in conjunction with the Nabataeans, while in inscriptions from the Hauran the same Shalamu appear as confederates of the Nabataeans. The important lesson to learn from all of this is the complexity of relationships between the various groups of people occupying N.W. Arabia at this time.

But let us now turn back to the Nabataeans in their nomadic, pre-sedentary period, and look at the problem of their origins. The evidence bearing upon this is entirely linguistic and epigraphic, and is well outside my competence. All I can hope to do is to repeat a few generally-accepted assumptions, and to ask for comments from my audience.

(1) The first assumption is that the Nabataeans were in origin of Arab stock. This is almost universally agreed today, though as long ago as 1835 Quatremère held the opinion that they were Aramaeans, and Simons in his *Geographical and Topographical Texts of the Old Testament* (1959) seems to incline to the same view. The basis of the 'Arab hypothesis' is the study of the Nabataean language made particularly by Cantineau[1], who showed that the personal and divine names were predominantly Arabic, and that the general vocabulary was also deeply influenced by Arabic, even though the written language and script were Aramaic. So far as I know, Cantineau's opinion has never been contradicted, although it would perhaps be useful if a new study of the names were made. The tribal name itself, now known from inscriptions to have been written *nbṭw* (Nabatu) comes, according to Starcky, from a root *nbṭ*, meaning 'to arise' or 'to appear', occurring not only in S. Arabian but also in Accadian and Hebrew (Jeroboam, the first ruler of Israel after the schism, was the son of Nebat). This fact does not, therefore, necessarily support the view that the Nabataeans must have been Arabs.

[1] Canutinea *Le Nabatéen* Vol. 1 (1930)

(2) The second point to command attention is the question of the connection (if any) between our Nabataeans on the one hand, and the Biblical Nebayoth and Assyrian Nabayat on the other. Many early scholars (and more recently Simons) accepted the identification, but Starcky's argument against it seems to me conclusive. He points out that the words are in fact quite different: first, because the emphatic *ṭ* of *nbṭw* is part of the root, while the soft -t or -th of Nebayoth/Nebayat is part of the plural termination; and secondly, because these latter words have a radical *-y*, whereas *nbṭw* has not.

(3) Starcky emphasizes the fact that the root *nbṭ* is particularly well-attested in S. Arabian, and argues from this that the Nabataeans were originally a S. Arabian people. But, as we have seen, the word is quite common in other ancient Semitic languages, and this argument should be discounted. But nevertheless it is generally assumed that the original home of the Nabataeans is to be sought in S. Arabia[2], presumably on the grounds that only there, in the southern part of the peninsula, could they have seen and learnt the advanced skills (especially farming and irrigation) which they mastered. This is a view I cannot accept. To begin with, there is absolutely nothing in the remains of the material culture of the Nabataeans which have been unearthed in, for example, Petra, to suggest a S. Arabian origin. Art, architecture, pottery, etc., are all derived from the Hellenistic Levant. Moreover, we must remember that N.W. Arabia was by no means a deserted backwater in the pre-Nabataean period. There had been for centuries contact between the North African tribes and Assyria and Babylon, as the annals of these empires show. Teima and Dedan were flourishing towns at least as early as the 6th century B.C., while the Persian period seems to have been a particularly prosperous one judging, for example, from the amount of tribute (1000 talents of frankincense) the Arabs were on one occasion able to pay Cambyses. This account (recorded by Herodotus) reminds us also that the Nabataeans were by no means the first of the N. Arabian tribes to traffic in precious perfumes and spices. We must also note the hoard of silver bowls (of Persian style) and jewellery found at Tell-el-Maskhuta (near Ismailya in the E. Delta), and dating to *c.* 400. One of the bowls bears an Aramaic inscription recording its dedication to 'Ilat by Qainu, son of Ghasmu, king of Qedar—the same Ghasmu (or Gheshem) who is mentioned in the Bible as one of the opponents of Nehemiah—and is eloquent testimony to the culture and wealth of the Arabs.

Recent investigations (and especially the discovery of Late Bronze Age ou Early Iron Age pottery on at least one site in the Hejaz) have pushed back the history of N.W. Arabia into the 2nd millennium B.C. This is the background, then, against which the Nabataean emergence must be set, and there is no reason at all to look farther south in the peninsula for their origins, except, possibly, in remote prehistoric times.

[2] See e.g. Nelson Glueck, *Deities and Dolphins* (1965), p. 4

DISCUSSION

Dr. Serjeant pointed out that the term 'Nabataeans' in Early Arabic writers refers to the Aramaeans of Southern Iraq, and impure Arabic was called 'Nabati'.

Dr. Barnett asked if this was the explanation of the use of the term 'Nabataean' for the description of a MS known to Maimonides in the 13th century called 'The Nabataean agriculture' which in fact described pagan practices.

Mr. Dayton asked whether the Nabataeans might not be derived from the Edomites of the Late Bronze Age.

Dr. Isserlin said that a study of Lihyanite names proved them to be of very mixed origins.

Professor Ackroyd asked whether Nabataean was a term denoting a locality or a people.

Mr. Parr: the latter.

THE CITY OF TEIMA AND THE LAND OF EDOM

by JOHN DAYTON

Teima today is a large oasis situated to the east of the Hejaz Mountains, in a depression which receives the drainage of a large area. It is an important staging post on the road to Medina and Mecca from Tebuk and Jordan in the north; while another route leads off through Hail to Riyad and Bahrein, or from Hail to Baghdad. A more direct route lies from Teima via Al Jawf to Baghdad, a distance of some 500 miles.

The remains of extensive walls stretch for several miles around, and at some distance from, the modern village, at the centre of which is a large rectangular well, stone lined, about 50 feet deep and some 80 feet square, from which Philby states some 100,000 gallons of water can be drawn a day.

The walls are constructed of flat limestone slabs bedded in mud, and built in panels. In places they stand some 20 feet high and half covered in drift sand. Inside the wall, approaching from the south, is a well-preserved stone compound about 100 yards square; a partly-filled-in well, and some small mounds on which are a few sherds of a very coarse and heavy pottery. Inscriptions on parts of the walls seem to be in a South Arabian script.

Teima, however, is famous as the residence for some 10 years of Nabonidus, last King of Babylon. The problem is why did Nabonidus spend so much time in remote Arabia, if in fact it was so remote in those times?

From the literary evidence we know that Nabonidus neglected Marduk, the chief god of Babylon, in favour of Sin to whom he built a temple in Haran. Sin was also the supreme god of South Arabia.

A stele tells us that in the third year of Nabonidus' reign 'he slew the Prince of Teima with the sword; the dwellers in his city and country, all of them they slaughtered. Then he himself established his dwelling in Tema; that city he made glorious . . . like the Palace of Babylon.'[1] Now Nabonidus' Palace in Babylon was truly magnificent, but there does not appear to be any very important ruin at Teima at the present time, at least not from the evidence of the surface remains.

Who was the Prince of Teima and his people? The Assyrians had from the time of Tiglath-pileser III campaigned in Arabia. In *c.* 742 B.C. against Rasunu, King of Damascus; Menahem, King of Israel; and Zabibe, Queen of the Arabs (could this have been a South Arabian Queen; for we know that there was a Sabaean frontier-post at Dedan?). In 734 an anti-Assyrian coalition of the Kingdoms of Palestine and Trans-Jordan had been organized by the Philistine rulers of Ascalon and Gaza. It failed: the Prince of Ascalon was killed; the Prince of Gaza fled to Egypt; Ammon, Moab and Judah and another Queen of the Arabs, Shamshi, paid tribute. The annals of Tiglath-pileser III of 728 B.C. record that the Mas'ai tribe, the city of Tema, and the Sabai sent him tribute of gold, camels and spices. It thus appears that Teima was not a city of the Sabaeans, as was Dedan, since it is mentioned separately. In 783 B.C. the Sabaeans are recorded as supplying incense for the altars of Babylon.

Circa 688 B.C. Sennacherib had destroyed 'Adumu', 'the fortress of Arabia', and taken away to Nineveh its gods, and its Queen. Before this, in 715 B.C., Sargon II had conquered Egypt, and sent his armies by a desert route. On their way they conquered the tribes of Arabia, including the Thamoud, who in later Roman times inhabited the *limes* and provided auxiliary horsemen. The Thamoud inhabited the Northern Hejaz, the area of Medain Salih and Tebuk. The central Arabian area was therefore well known to the Assyrians, who in their campaign of 715 B.C. subjugated Edom, Moab, and Judah.

On a stele of Nabonidus recently discovered at Haran[2] we read 'I hied myself afar from my city of Babylon, on the road to Teima, Dadanu, Padakku, Hibra, Iadihu and *as far as* Iatribu; ten years I went about amongst them and to my city Babylon I went not in.' From this it appears that the limit of Nabonidus' journey was Iatribu, the ancient name for Medina (Yathrib); Dadanu would be Dedan, modern al-'Ula, the northern frontier-post of the Sabaean Kingdom; Hibra could be modern Khaibar on the road from Teima to Medina; Padakku might be the Thapua of Ptolemy, modern Tebuk.

[1] R. P. Dougherty, *Nabonidus – Belshassar*, New Haven (1929), pp. 106–7.

[2] C. J. Gadd, 'The Harran Inscriptions of Nabonidus', *Anatolian Studies* VIII (1958), 35–92.

The Teima stele,[3] which is written in Aramaic, refers to a local priest of Teima Salm-shezeb whose father's name Petosiri is Egyptian. The style and carving of the stone, however, and the god and the priest depicted thereon are emphatically Assyrian.

Contact therefore existed with Egypt. Dedan after all is only 60 miles to the west, and from Dedan one of the few possible routes through the mountains leads to Al Wejh on the coast, the possible Leuke Come; while the age-old caravan route runs from Dedan northwards to Gaza and Egypt.

Nabonidus may therefore have been busy in Arabia, keeping the route open to his allies in Egypt and controlling the rich caravan trade of the Hejaz, together with its mineral wealth. Recent research has located some 55 ancient goldmines in the area. Teima would also have been a city of refuge, far from the might of Persia.

It is possible that the land of Edom may have covered a greater area than has been thought. The fortress of 'Adamu' could be that of Edom, and may well be the site Qurayyah recently visited by Mr. Parr, Mr. Harding and the writer; and not Dumat-al-Jandal as has been suggested.

The Bible contains several important clues in this respect. In *Ezekial* 25 v.13 is states 'in Edom the people will be destroyed and the land lain waste *from* Teima *to* Dedan', as if confirming that the boundaries of Edom extended as far as these two cities. Apart from Midian, we have no other record of any state existing north of Dedan, from where the Edomites would take over the caravans northwards to Petra, Gaza, and Damascus. In *Isaiah* 21 we read of the fall of Babylon to the Persians, and of the 'burden upon Arabia', and of the 'travelling companies of Dedan', a direct reference to the caravan trade. We read that 'the inhabitants of the land of Teima brought water and bread to those who fled from Babylon'—which must have been by the central Arabian route. Perhaps the reference in *Jeremiah* 49 v.7 'is wisdom no more in Teima' refers to the end of Nabonidus' rule, and here again Teima is linked with Dedan. In the *Book of Job* we get many references to Teima and Dedan, and the land of Uz which is mentioned in *Jeremiah* 25 v.20 in the list of countries that goes from Judah to Egypt, then Philistine territories, and Edom, Moab and Ammon.

In *Job* we get the famous passage relating to mining which we know was carried on in the mountains of Midian and the Hejaz. In Jaussen and Savignac, inscription JS 34 we read of Galti-Qaus, governor of Dedan. Qaus is the God of Edom and it thus appears that his territory extended as far south as Dedan.

CONCLUSION

It therefore appears that Teima was an important place before the time of Nabonidus who reigned from 556 to 538, in the time of Sargon II and Tiglath-

[3] R. P. Dougherty, 'A Babylonian City in Arabia', *American Journal of Archaeology* 34 (1930), 296–312.

pileser III, and no doubt before them. We have seen the Egyptian influence on the Teima stele, and the Philistine connections with Ammon, Moab and Arabia in 734 B.C. which is to be expected as they controlled the northern end of the caravan route and would oppose any threat to it. Earlier the battles of David with the Philistines were no doubt for control of the trade route which contributed so much to the wealth of Solomon. It is very possible that Edom, 'the Red Land', extended as far south as Teyma and Dedan, to the northern boundaries of the Sabaeans. Edom, far from being destroyed by Solomon and David, survived until Roman times (Herod was an Indumaean) and significantly always had close connections with Philistia and Egypt. Tracing the boundaries of the Land of Edom represents a very worthwhile archeaological task. Excavation will throw new light on this underestimated area of the Middle East, and may well tell us who was the King of Teima slain by Nabonidus.

DISCUSSION

Dr. Barnett pointed out that the use at Teima of dug stone walling of thin horizontal slabs was paralleled at Zimbabwe.

Professor Lloyd: Thamudaean inscriptions on the slabs of the Teima walls provided a *terminus post quem*.

Mr. Parr referred to Palestinian 8th/7th century B.C. red-polished ware in the Riyad Museum found at Teima, and to sherds (also stated to be from Teima) which were identical with those of Late Bronze or Early Iron Age date found at Qurayyah by Mr. Dayton and himself.

SOUTHERN ARABIA

by BRIAN DOE

The country of Southern Arabia, with a coastline extending from the Red Sea to Dhufar was known in ancient times as the Frankincense country. It was even called this as late as the early 3rd century A.D. by the author of the Periplus of the Erythraean Sea. To the Romans it had been known earlier as an Eldorado from whence all the luxury commodities and incense emanated.

To find out more, they even sent an expedition during 25–24 B.C. which reached as far as Marib. Here the leader Aelius Gallus met the forces of 'Ilsharah, the prince of the city of the Sabaeans. This is one of the few occasions when literary references can be linked to a ruler mentioned in South Arabian inscriptions of the period.

The kingdoms of early South Arabia had formed along the best trade routes which carried spices and goods from India and the East and from Africa, as well as incense. The main route extended as far as the country of the Nabataeans and there was a trading-post of the Minaeans at Al-'Ula. In this manner, by encouraging the trading caravans, providing safe passage through their land and collecting lucrative toll charges, the kingdoms of Ḥaḍramut, Qataban, Saba', Himyar and Ma'in flourished.

The route from the bay of Bir 'Ali at the site of Qana', the main port of Ḥaḍramaut, northward to the site of Mayfa'at, ancient capital of lower Ḥaḍramaut in the Wadi Mayfa'ah, and passing over the mountains to the head of the Wadi Jirdan was one of the old caravan routes to Shabwa, the capital of Ḥaḍramaut when this kingdom extended as far as Dhufar. With a high range of mountains on the north of the coastal plain Dhufar provided a unique climate in Arabia for the natural growth of frankincense trees. It was from here that the best incense used in the temples of the countries of the eastern Mediterranean and the Fertile Crescent was transported by sea and land. During the period of the western land routes this trade passed through Qana' and Shabwa although after the expansion of Himyar it seems likely that the actual route did not pass Mayfa'at but went through a gate of the great defence wall of Qalat in the mountains north of Qana'.

When looking at general air views of the isthmus of Qana' with the dominating rock of Husn-al-Ghurāb at the tip one can see that there had been two harbours giving protection from the monsoon winds. Qana' with some of the foundations of main buildings was built on an area of level rock. Cisterns and buildings were repaired in the 6th century A.D. by Samyafa' 'Ashwa' and this episode was recorded in a ten-line inscription placed on a flat stone at the top of the zig-zag path leading to the summit of Husn-al-Ghurāb. A second inscription mentioned the town of Qana', the ruins of which lie below.

The walled town of Mayfa'at dominated the caravan route through the wadi. There are two entrances each flanked by towers which do not show evidence of actual gates having been hung. The southern entrance, through which the visitor has to proceed along a right-angle passage before entering the town, has a long inscription which describes the construction of the walls of massive blocks of masonry, which may have been improved for protection from the Himyar.

The mud-brick palace with the decorative ibex horns placed on the corners and the medieval houses of the town of 'Azzan near-by indicate the continual need for an administrative centre here for the area. In the Wadi Amaqin, which lies to the north, the town of Al-Hauta serves as a modern trade centre for the whole area, the goods being brought from the small coast ports along a route similar to the old incense trade.

It is possible to trace this route from the wadi along the mountainous track to the old building of La'abal on the level *jol* to the head of the Wadi Jirdan on the north, with its view of the large medieval fortress farmstead of mountainous Al-Janainah and its three mud-brick towers or *husns*.

On the 19th June, 1969 in association with the Middle East Centre, a Symposium was held at Cambridge, and the following papers were presented:

(*1*) *Dr. R. B. Serjeant:*	*The Yemen.*
(*2*) *Professor Dr. Walter Dostal of Berne:*	*Ethnological observations in Tarim, accompanied by films of local crafts.*
(*3*) *David Whitehouse:*	*Exported objects from Siraf* (*Southern Persia*) *in the 8th–12th centuries A.D.*
(*4*) *Dr. R. D. Bathurst:*	*Historical problems for archaeology in Oman.*
(*5*) *Miss B. de Cardi:*	*Field surveys in the Sheikdoms of Ras al-Khaima and Fujeira, Trucial States.*
(*6*) *Brian Doe:*	*Expedition to Socotra with film.*

Book Reviews

MALIK, S. C. *Indian Civilization, The Formative Period.* Indian Institute of Advanced Study, Simla, 1968. 214 pp. 13 figs. 45s.

As its sub-title, 'A Study of Archaeology as Anthropology', suggests, this book is concerned with interpretation and the archaeologist's approach to his subject, rather than a detailed account of archaeological material. The first part of the book is devoted to a review of the work done in India from the end of the eighteenth century until the present day and an assessment of the attitudes adopted towards the subject, followed by an exposition of the author's views on the part which should be played by the anthropological approach to Archaeology and History, and the part which Archaeology, anthropologically interpreted, can play in evaluating what he terms the 'Indian Style' in present-day India as well as in the past. He gives a detailed account of the anthropological interpretation and division of stages in the evolution of human societies, and at the beginning of his chapter on the 'Formative Period' (The Harappan and related cultures) defines the anthropological terminology at some length. He then enumerates, and comments on, the cultural regions and their interrelation. After this he comes to the core of his subject, the re-interpretation of the archaeological evidence for the rise and spread of the Harrapan civilisation, followed by the coming of the Aryans and their relationship with the pre- and non-Aryan populations. For this latter aspect he uses both archaeological and textual evidence to support his thesis that the Harrapan tradition survived not only in outlying areas but also by absorbtion into the Aryan tradition, thereby transforming it into the 'Indian Style'. His reconstruction of Harappan society, and emphasis on present parallels as survivals, may be considered open to question on present material archaeological evidence and thus appear somewhat exaggerated, but since he admits to the use of exaggeration to drive home his point on the use of the anthropological approach, it would be churlish to take him to task on this. The last chapter is again concerned largely with the anthropological approach, this time to India as a whole and the problems of regionalism within an overall unity of culture.

That part of the book devoted to the interpretation of the 'Formative Period' is specifically aimed at those with a knowledge of the archaeological literature and does not aim at giving a detailed review of the material culture. There is an extensive bibliography at the end of each chapter, covering Indian and European works on Archaeology and Anthropology quoted in the text. The book is an interesting, if somewhat controversial, contribution to Indian archaeology which should stimulate discussion on many aspects of the subject. (There are, unfortunately, one or two printer's errors which cause occasional confusion.)

JUDITH T. PHILIPS

JIŘI NEUSTUPNY. *Museum and Research.* Muzejní Práce, Vol. 13, 1968. Office of Regional and Museum Work of the National Museum in Prague. 160 pp. 15Kcs.

JIŘI NEUSTUPNY. *Otázby pravekekého osídlenć Ceskoslovenského územi.* (*Problems of the prehistoric settlement of the Czech lands.*) Sborník Národného Muzea v Praze. Ser. A, Vol. XXII/2, 1968.

The National Museum of Prague is one of the great museums of Central Europe, and celebrated 150 years of activity in 1968. The many prehistorians who have visited it must have been struck by the obvious care and thought which has gone into the preparation of the exhibitions, just as much as the scale of work in the offices and depots. Jiři Neustupný in these two works had set out to generalise the theoretical basis of both museum exposition and research in the first, and in the second to summarise with regard to Czechoslovakia some of the main conclusions about settlements, peoples and cultures which arose from the research which went into the preparation of the 1966 exhibition in the National Museum.

J. G. NANDRIS

HENCKEN, Hugh. *Tarquinia and Etruscan Origins*. Thames & Hudson, 1968. 248 pp. 50 figs. 173 pls. 42s.

This book is a summary of Dr. Hencken's two large volumes, *Tarquinia, Villanovans and Early Etruscans*, which appeared in 1968. It deals with the cultural development at Tarquinia, the south-coastal metropolis of Etruria, as shown by the tomb-groups: following the guide lines laid down by Pallottino and Müller-Karpe, the material is separated into sub-divisions of Villanovan I, Villanovan II and the Orientalizing period of the seventh century B.C., when inscriptions show the presence of the Etruscans. Strictly within these periods, Hencken has isolated features which show Italic continuity and foreign elements and has described the latter under headings of Balkan, central European, Aegean and east Mediterranean influences. With this wide background in mind, he has then re-examined the traditions and theories concerning the origin of the Etruscans.

The description of the material evidence from Tarquinia and the re-statement of the problems is a fundamental contribution to the subject and the main attributions will be widely accepted, though some criticisms must be made. One may question the validity of some typologies and datings, upon which rest the historical implications. For example, can one be certain that Villanovan I objects, showing Aegean or east Mediterranean analogies, such as the small tripods, the arch fibulae with twisted bows or the T-hilt swords, do not stem from twelfth- or eleventh-century influences and thus invalidate both the early date for the beginning of Villanovan I and the evidence for prolonged contact during the tenth and ninth centuries? Again, the precise moment of the arrival of the 'geometric Greeks' in the west Mediterranean is important, since they may well have introduced east Mediterranean elements into Tuscany during the eighth century. Perhaps the most important reservation to be made concerns the dating of Villanovan II: Dr. Hencken's case for beginning this period about 750 B.C. rests mainly on the belief that certain fibula types occur in Greek colonial graves at Pithecusa before they appear in Tuscany and influence the Villanovan II B types. If, however, these fibula types evolved in Tuscany, as seems probable from the study of the sequence, then the Pithecusa graves actually provide a *terminus ante quem* for both Villanovan II A and B of about 720 B.C. Such a chronology, starting Villanovan II about 800 B.C., has recently been proposed by Dr. Close Brooks, based on an analysis of the tomb-groups, typologies and imports at Veii (*Notizie de gli Scavi* 1965, 53 ff. and *Studie Etruschi* 35 (1968), 307 ff.).

The book is produced in the admirable manner of the Ancient Peoples and Places series and, though it is more detailed than is usual with these books, it is nevertheless invaluable to the student of Italian prehistory. Thanks to Dr. Hencken's wide knowledge of the Italic, European and Mediterranean background, a concentrated study of a single, important city has provided not only a fine description of its material development but also elucidated some crucial problems of the origin of the Etruscans.

ELLEN MACNAMARA

MOORTGAT, Anton. *Vorderasiatische Rollsiegel*. Berlin, Mann, 1966. 155 pp. 95 pls.

The reprint of this publication is very welcome since it has long been out of print and contains the catalogue of the cylinder seal collection (at the date of publication, 1940) of the Vorderasiatische Museum in Berlin. This includes seals from the German excavations at Ashur and Babylon. The book is divided into two parts, an introduction and the seal catalogue proper. In the introduction Professor Moortgat undertook a survey of the history of cylinder seal engraving, almost contemporary with a similar undertaking completed by Henri Frankfort in 1939 and published as 'Cylinder Seals'. There were several divergences of opinion between Moortgat and Frankfort, which there is no space to go into here. Later evidence and further studies have enabled us to complete more or less the work begun by these two scholars, but there are still a few gaps.

Archaeologically the most valuable seals of the collection are the early and late Assyrian seals from Ashur, together with the few Kassite and late Babylonian seals from Babylon. Professor Moortgat's chapter on late Assyrian seals of the ninth and eighth centuries B.C., which was based on careful study of the evidence from Ashur, is still relevant. His date for the *kerbschnit* seals is supported by their appearance in the shrine of Adad Nirari III at Tell Rimah.

BARBARA PARKER

HALLO, William W., and VAN DIJK, J. J. A. *The Exaltation of Inanna.* Yale University Press, 1968. 102 pp. 12 pls. 90s.

This book is the full publication of a Sumerian hymn to the goddess Inanna, entitled nin-me-sár-ra='Lady of all divine powers'. It was composed by or for Enheduanna, the daughter of King Sargon of Agade and high priestess of the moon god at Ur. The composition comes down to us from many copies made in the old Babylonian scribal schools of Ur and Nippur. The theology of the hymn is concerned with the elevation of the goddess Inanna within the Sumerian pantheon; divine power politics reflecting the earthly domination of Sumer by Sargon and his dynasty. The Akkadian Ishtar, the planet Venus, was assimilated to the ancient Uruk goddess of the sexual act and procreation to become the most powerful goddess of the Babylonian pantheon. Enheduanna's literary productions, and much other literature from the scribal schools, were concerned with her rise to power. This particular hymn has a historical framework; the expulsion of Enheduanna from her high office at Ur in the course of a Sumerian revolt against the domination of the Agade dynasty during the reign of her nephew Naram-Sin. The restoration of the priestess to her high offices, which may have included Uruk as well as Ur, is regarded as due to the intervention of the goddess.

The poetic imagery of the hymn is of particular interest for iconography. The goddess is described as flying over the battlefield and coming in the guise of a roaring storm, accompanied by the thunder god Ishkur. Professor Hallo has drawn attention to the probable identification of Inanna as the winged goddess with eagle feet of the terra cotta 'Burney relief'. It seems possible that the goddess may also be represented by the naked woman holding lightning shafts in her hands, who rides a dragon drawing the weather god's chariot. This scene occurs on at least three cylinder seals of the Agade period.

Professors Hallo and Van Dijk have made a very full study of this fascinating text which contains many other points of interest and difficulty for the study of Sumerian ideas.

BARBARA PARKER

JIRKU, Anton. *The World of the Bible.* Trans. by Anne E. Keep. London, Weidenfeld and Nicolson, 1967. 167 pp. 64 pls. map. 45s.

This volume, a translation of a work which first appeared in Germany in 1957, gives (according to the dust jacket) 'a vivid account of the history of the Israelites, and of the growth of Canaanite culture, from its beginnings to the Roman era'. This is true enough; but what the dust jacket does not say is that the account is also ill-balanced and often unreliable. Jirku is at his best when retelling the history of the 1st millennium; his survey of the biblical period, although brief, is well-written and enlivened with apposite quotations. His treatment of Canaanite mythology is also adequate for its purpose, and includes long excerpts from the Ugaritic texts. These sections of the book should prove interesting to the layman, though they are not such a good introduction to the same subjects as, for example, Gray's *Old Testament World.* But on the archaeological side the volume is very weak, and the earlier pages in particular are full of inaccuracies, omissions and half-truths. It is nonsense, for example, to say that Jericho 'was surrounded by seven walls' in the 3rd millennium (p. 10) and quite wrong to maintain that the walls of *c.* 1400 at the same site have been excavated (p. 36). Neither is it true that 'on the basis of excavation it can be established that in about 1750 B.C. many cities in Palestine and Syria were destroyed, (and) that from then onwards jugs and pots are of new ceramic types' (p. 13). The brief discussion of Canaanite temples on p. 48 makes no mention of Hazor: the Ras Shamra palace is not described; the survey of Canaanite burial customs (pp. 49–50) is so inadequate as to be worthless; and (on the same subject) the amazing statements are made (p. 120) that the Ajjul horse burials are of the Israelite period and that iron coffins appear at the same time! If the archaeological evidence is to be used at all in a work of this nature it should be treated with greater respect than this.

The volume is attractively produced and unstinted praise can be given for the large photographs, some of rarely illustrated monuments such as the Sheikh Sa'd lion and the Amman royal statues. The translation is good; but it is a pity that the bibliography contains no work later than 1958. All in all, this is hardly a volume which will detain the serious student of the subject.

PETER J. PARR

REICHEL-DOLMATOFF, G., *Colombia*. London, Thames and Hudson, 1965. 231 pp. 70 figs. 65 pls. 35s.

MEGGERS, Betty J., *Ecuador*. London, Thames and Hudson, 1966. 220 pp. 50 figs. 76 pls. 35s.

Thames and Hudson deserve thanks for commissioning books on two of the 'poor relations' of New World archaeology. The important work done in Colombia and Ecuador during the last decade has mostly been published in Spanish or else in periodicals not readily available in Britain, and these two books are the only authoritative accounts in English.

In Colombia the most striking developments have come from the excavations of Professor Reichel-Dolmatoff and his wife in the coastal lowlands. The shell mound of Puerto Hormiga has yielded the oldest pottery in the Americas (with a radiocarbon date of 3090 B.C. ±70), and from the Caribbean coast we now have a sequence of pottery styles leading right up to the Spanish conquest. Elsewhere along the coast the author has established a number of dated local sequences which stretch back into the first millennium B.C.

In the highlands the situation is entirely different. Museum cases all over the world contain goldwork and fine pottery looted, without any documentation, from Andean cemeteries and labelled—rather vaguely—'Quimbaya', 'Calima' or 'Nariño'. Archaeological information about these cultures is negligible, except at San Agustín where Duque Gomez has recently worked out a three-phase sequence beginning near the middle of the first millennium B.C. Most of the carved statues and megalithic temples belong to his second period (with C14 dates of A.D. 425±150 and 1180±120) and to his third phase (of uncertain duration).

If the book has a weakness, it is the author's lack of interest in highland archaeology. Information is scanty, but material plentiful: excavations in the Calima and Cauca valleys have shown that the lump-term 'Calima' covers at least two pottery styles which can be stratigraphically separated, while a doctoral thesis by Karen Olsen Bruhns has demonstrated on typographical grounds that 'Quimbaya' ware is made up of several distinct styles which cannot all be contemporary. The same must be true of the material from the Nariño shaft graves. This area is barely mentioned in the text, and the illustrations of Nariño vessels are more misleading than helpful. Fig. 27 is said to be painted in Quimbaya style but is in fact pure Nariño, while Plates 19 and 20 illustrate what are clearly Quimbaya imports into the Nariño province.

In compensation for this meagre treatment of the southern highlands Professor Reichel-Dolmatoff gives good short accounts of the Chibcha and the Tairona. As an anthropologist who has worked among the Cogui descendants of the ancient Tairona, he makes some illuminating comments about life in the Sierra Nevada de Santa Marta during the late pre-Spanish period.

Ecuador appeared when the press had already titillated the public appetite with stories of Japanese fishing boats carried across the Pacific to bring the knowledge of pottery-making to the New World. Dr. Meggers has been one of the most persuasive advocates of trans-Pacific contacts, and in Ecuador she sees Asiatic influence in two phases: Valdivia (starting about 3200 B.C.) which can be correlated with the Jōmon cultures of Japan, and again in the Bahía phase around 500 B.C.

It must be conceded that she has a case worth putting forward. Selected Valdivia sherds can indeed be matched among Jōmon fragments, and the Valdivia style has no local antecedents. On the other hand the high dating proposed for the beginning of Valdivia is suspect, for it is based on a single radiocarbon date more than five hundred years older than the six others which refer to early Valdivia. Nor is Valdivia an isolated phenomenon: pottery (admittedly of a very different kind) was already in use at Puerto Hormiga, and there may well be other undiscovered styles of comparable age.

On the coast, new work by Lanning and his associates has revealed pre-ceramic cultures in the Santa Elena peninsula. The earliest, Exacto, industry includes burins and has been tentatively dated *c.* 10,000 B.C., and a more recent biface industry is known from about 8000. But there is still nothing to show what came immediately before Valdivia. Lanning's team has also demonstrated that Machalilla pottery does not overlap with late Valdivia, as Meggers believes, but follows directly after it.

Evidence for Asiatic contact in the Bahía phase is based on the sudden appearance in Pacific Ecuador of several new traits. These include houses with saddle roofs, pottery head-rests, Pan pipes arranged with the smallest tubes in the centre, 'golf-tee' earplugs, anthropomorphic tusk-shaped pendants, and figurines with one leg crossed over the other. All these features have prototypes in the Far East and may well be intrusive into Ecuador. It is worth remembering, however, that the Pan

pipes and the roof design are known only from clay models and that the originals may have been in use much earlier. The tusk pendants are not a very specialised form, and the cross-legged posture sometimes occurs on figurines outside Ecuador altogether. The evidence for Asiatic contact is not conclusive, but it is too strong to laugh off.

The rest of the book is less controversial. The highlands are almost an archaeological blank until A.D. 500, and the emphasis is therefore on the coast where Estrada, Evans and the author have carried out so much valuable work from 1953 onwards. The results of this collaboration are summarised in a form convenient for expert and non-specialist alike.

WARWICK BRAY

BROTHWELL, Don and Patricia. *Food in Antiquity*. London, Thames & Hudson, 1969. 248 pp. 67 pls. 42s.

This volume is a particularly welcome addition to the *Ancient Peoples and Places* series because it covers a subject on which little has so far been published. This is partly due to the fact that only recently have modern techniques of archaeology begun to build up a comprehensive body of direct evidence for the diet of early man, not only by detection of plants and animal remains but also by a study of human stomach contents and coprolites. Because this is such a new study, the authors have inevitably been thrown back on relatively late sources for their information, such as classical texts, illustrations from Egyptian and Near Eastern monuments and analogies with present-day non-industrial societies. Mrs. Brothwell has made a special study of the ancient literature and drawn together a number of interesting references from diverse sources not only regarding the plants and animals selected but also methods of preparation, cooking and storage.

In their Introduction, the authors recognize the biased nature of their evidence which leads, for example, to an apparent emphasis on the larger mammals in the diet of prehistoric people due to the greater survival and/or collection by excavators of this group compared with the smaller and more fragile bones of smaller mammals, fish and birds. There is also a disparity between the animal and vegetable kingdoms in so far as remains of animal food are present from the Palaeolithic period onwards whereas root and green vegetable remains seldom survive even when cultivated and can only be known directly from written records, although they must have been used from the earliest times, too.

Apart from the expected chapters on Animal Food (Vertebrate and Invertebrate), Cereals, Vegetables, Fruit and Nuts, more unusual items are included by the authors, such as Sugars (derived both from honey and plants), Fungi, Oils, Herbs, Condiments and Drinks. Surprisingly, one finds that our present-day vegetable diet is more conservative than in classical times when Greeks and Romans not only relished most of the vegetables eaten in the Western World today but added mustard, nettles, docks and mallow as green vegetables, while the Egyptians even cooked hollyhock leaves.

Whilst appreciating that the authors are tied by the dictates of the format of the *Peoples and Places* series as to size of volume and approach, one cannot help regretting that the attempt to mention within 192 pages all animal and vegetable foods used from the Palaeolithic to the early centuries A.D. inevitably lends a 'menu-like' brevity to much of the text. In particular, one would have liked to see an enlargement of the sections which are Don Brothwell's special study—the sources and interpretation of the data regarding man's diet in the past and the effect it had on population numbers and diseases. The few pages devoted to these sections could only hint at the problems and possibilities, thus leaving a gap between this volume and its companion 'Bones, Bodies and Disease' by Calvin Wells.

Unlike other books in the series, however, *Food in Antiquity* enables the student to follow up some allusions to discoveries relatively easily since there are numbered references in the margins of the text to the bibliographical source. Even so, more of these would have been welcome. None the less, the authors are to be congratulated on a comprehensive survey of such an important aspect of man's life.

JOAN M. SHELDON

SARNOWSKA, Wanda. *Kultura unietycka w polsce*, vol. I. Wrocław-Warszawa-Kraków, 1969. 383 pages, 162 figures in text including a series of small distribution maps, with a summary in English.

The author of this competent and very useful paperback is the Director of the Archaeological Museum in Wrocław in Poland, to whom mainly the Museum owes its rebirth from the wartime destruction and its present growth.

The volume is divided into two parts. The first one, analytical, is devoted to the description of, and discussion on, the actual archaeological material of the culture, its typology, analogies and chronology, and its special features. The second part contains the description of all sites attributed to the culture.

Two Unetice provinces, the southern and the northern, have been distinguished. To the first of these belong sites in Middle and Lower Silesia and in the southern part of Greater Poland; included are also a few sites of the Grobia I (Grobska I) culture looked upon, so far, as forming a distinct culture. The northern group consists of finds of the Iwno and Grobia-Smiardowo (Grobska II) cultures, considered hitherto as different and independent cultures. Their close relation with, and the similarity to, the Unetice culture has often been mentioned by the authors concerned, but their inclusion into the Unetice culture of Poland, as its local branches, has been done here for the first time. Dr. Sarnowska emphasizes that the similarities and various features which they have in common definitely prevail over the differences (p. 57). Their inclusion seems reasonable, although their pottery —being of a similar style—nevertheless differs from the genuine Unetice ware. As a matter of fact, the differences between these groups seem to be of a lesser degree than those between the various groups of the Lusatian culture of the Middle and Late Bronze Age in Poland especially those of the western and eastern parts of the country. On the other hand, bronze objects found within the whole Polish Unetice area represent genuine Unetice types.

The discussion on the various types of finds starts with settlements, only ten of which have been recorded, all exclusively in Silesia. It may be added that the author keeps strictly to the political boundaries of Poland and thus a number of sites of the Unetice culture on the other side of the Oder and the Nisa (Neisse), just across the border in Lusatia (East Germany), have not been taken into account although they evidently form part of the same regional groups (see map fig. 162, p. 353). Next dealt with are the graves of the southern and then of the northern groups (map fig. 2, p. 31). Striking is the widespread custom of surrounding the burials by stones, burials in stone cists especially in the northern group, and heaping of cairns over the graves.

Pottery found in the graves of the two groups has been discussed separately but bronze objects and other finds have been handled jointly, as there is no substantial difference in this respect between the two groups. Short chapters have been devoted to the economy and trade connections of the Unetice population, to its beliefs and to its social differentiation, well attested by the richly-furnished 'princely' burials in barrow graves. Finally, the origin of the Unetice culture in Poland and of its regional groups, and their chronology and division into stages have been deliberated upon. The author points to the continuity of development within the whole area: all groups of the Unetice culture in Poland evolved out of the neolithic substratum of the preceding period under the influence emanating from the south and west, especially that of the Bell-Beaker culture. In Silesia, the substratum was the local Marszowice Corded Ware culture, and the Oder and other groups of Corded Ware in the areas further north. Another important formative factor, the Globular Amphorae, has not been taken into account by the author (see my *Polska przedhistoryczna*, London 1959, 284 pp., 286 ff., 291).

Three stages in the development of the culture in Poland have been distinguished, although each of the groups had passed through only two of these. The first stage (dated as 1900–1700 BC) is represented only in Silesia, and the third one (1550–1450 B.C.) exclusively in the north. It is only during the second stage (1700–1550 B.C.) that the culture was in existence over the whole area of its extent in Poland; its date has been confirmed recently by Carbon 14 determination, 1665 ± 40 B.C., of the main burial A in barrow grave I at Łęki Małe.

The second part of the book, about two-thirds of its contents, is devoted to a detailed description of the 367 sites attributed to all groups of the culture, arranged according to the present administrative division of the country. The 22 last pages (pp. 354–375) include a brief review of the content of all burials and hoards of bronze objects arranged in tabular form; some special types of the latter have been listed separately. The closing eight pages contain a summary in English; some of the terms

applied there are inappropriate, e.g. colonization, stations, treasuries, ceramics, stone cases, casting house, instead of settlement, sites, hoards, pottery, stone cists, foundry.

The book is an important and welcome contribution to the knowledge of the earliest stage of the Bronze Age in Poland. The material has been well described, presented and correctly dated, and its external connections and similarities have been pointed out. It is only the technical side of the book which may be reproached. There are no indexes, not even an index of sites dealt with and quoted in the work, which is a very bad usage common in Poland and in other East European countries. It renders very difficult the use of books of this type. One is often exasperated in trying to find the description of a site for reference or checking, as no one outside Poland is supposed to know exactly to which administrative unit it may belong. Furthermore, there is no indication how to identify the numbered sites on the distribution maps, nor how to find the number of a given site in order to fix its geographical position on a relevant map. The division into three chronological groups of the burials and hoards listed in the tabulae would be very desirable.

It may be hoped that the second volume of the work will be free from these shortcomings and will supplement the omissions mentioned above. The second volume, as announced, will be devoted to the study of the influence exercised by the Unetice culture in Poland on its neighbouring and co-eval cultures, and will also give the results of the spectographic analysis of bronzes, and the results of the anthropological study of the osseous material from the burials of the culture.

T. Sulimirski

COLLEDGE, M. A. R. *The Parthians*. London, Thames and Hudson, 1968. 187 pp. 46 figs. 76 pls. 2 maps. 42s.

The place of the Parthian Empire in the history of the Near East is more paradoxically obscure than any other epoque of comparable length. Out of the millennium which intervened between the fall of the Achaemenid Dynasty and the Muslim conquest of Persia, one hundred years of Hellenistic rule are well documented in Greek literature: so are the four centuries attributed to Sassanian rule by Roman historians. Between the two, however, lies the strangely dark age dealt with in this book; five hundred years of political continuity and cultural development in 'greater Iran', until recently almost totally neglected by antiquarian scholarship.

In this work, Mr. Colledge rightly emphasises the injustices to the Parthians perpetrated by early historians; Roman propaganda which regarded them as 'treacherous, bellicose and arrogant Barbarians with curious and distasteful habits'; Sassanian writers who, for political reasons, artificially reduced Parthian chronology by almost 250 years. The total disappearance of official records (written on perishable material?), leaves the authentication of retrospective speculation to the numismatist. Mr. Colledge himself then contrives a satisfying summary of contemporary history—a dull subject in the days when one's approach to it was limited to George Rawlinson's 'Sixth Oriental Monarchy', but intelligible when Graeco-Roman, Sassanian, Hebrew and even Chinese sources contribute to its reconstitution. Next, he appends a study of Parthian culture as it is now beginning to emerge, greatly illuminated in comparatively recent years by the increasing attention of Western scholarship. Where art and architecture are concerned, he no longer finds any lack of material on which to build this picture. Herzfeld, Rostovtzeff, Pope and Ghirshman are names among those who, in our own time have interpreted the Parthian antiquities of Iran itself. In Iraq, German archaeologists, intent upon the remains of earlier periods at Warka, Ashur and elsewhere, have attended to the aftermath of Parthian occupation, while Parthian exposures on an even larger scale have been made at sites like Seleucia-Ctesiphon and Dura Europos. Finally at Hatra, the excavations now prolonged for a decade have revealed the wealth and refinement of life among the vassal princes of the Parthian Empire.

Colledge analyses the total of information with which we have thus been supplied, and skilfully appraises the evidence of Parthian achievement which it represents; the deteriorating overlay of classical culture in the early years after the departure of Alexander and his Diodochi; the revival and substitution of a more congenial orientalism, and the bequest of new criteria and conventions to the Persian art of later times.

The whole subject is here admirably studied and the line-blocks of unfamiliar architectural subjects particularly commendable.

Seton Lloyd

BUCCELLATI, G. *The Amorites of the Ur III Period*. Istituto Orientale di Napoli, 1966. 379 pp. 14 pls. L.I. 8,000.

Writing on the West Semitic peoples, I. J. Gelb promised a forthcoming treatment of the Amorite names known from the Third Dynasty of Ur. This has now appeared over the name of G. Buccellati, to whom Gelb made over such material as he had collected, as is duly acknowledged in the preface.

The Amorites are a people about whom much new information has recently come to light. A group of nomadic Semitic tribes of the Syrian desert, they were originally regarded by city dwellers as uncivilized barbarians, but after some centuries of infiltration and settlement in the cities of the Fertile Crescent, they founded the brilliant group of dynasties of the Old Babylonian period. Their language remained unwritten, but we have a very fair idea of it from their practice of using 'sentence-names' (e.g. *Hammu-rapi*='Hammu has healed'), which throw light on most of the basic grammatical forms.

In the past, controversy has centred on their place of origin, now no longer in serious doubt, and on the propriety or limitations of the term 'Amorite'. In considering the latter a study of Amorite names of the Ur III period has particular relevance, for it is at this date that names glossed in Sumerian MARTU (i.e. Amorite) appeared for the first time in significant numbers in the cuneiform record. The work under review falls into two parts, first a consideration of the linguistic affiliation of the language, which represents a more archaic form than the better-known Amorite of the IInd millennium, and second a historical reconstruction of the social background. Both approaches are fruitful. Under the first heading the sources are comprehensively reviewed and the onomastic material analysed, and under the second, the implications of nomadism and settlement, a recurrent social pattern in this part of the Middle East, are examined in detail. The book is marred by a series of gross typographical errors, which annoy but seldom seriously damage. Apart from this, the onomastic analysis provides a useful tool, while the consideration of the society, although perhaps excessively circumscribed by the terms of reference, will offer valuable material when a wider study of ancient nomadism comes to be written.

DAVID HAWKINS

BARDTKE, Hans. *Bibel, Spaten und Geschichte*. Koeler & Amelang, Leipzig, 1969. 363 pp. 4 pls. 115 figs. 2 maps. DM 22.80

This book is intended for the 'interested layman', yet the text betrays such scholarly research that one is tempted to suggest the book as a reference work.

Bardtke's purpose is not an Apologia for the Bible, but a scholarly, 'historisch-kritisches' understanding of the Bible in the light of philological and archaeological research. He begins with the Bible as a historical source and follows with a necessarily brief account of 'archaeology'. Only in his treatment of the more technical aspects is there some ambiguity; otherwise this introduction presents an excellent basis for the material which follows.

Chapters III and IV present the philological background of biblical history: extrabiblical inscriptional evidence such as Egyptian and Assyrian texts, commemorative stelae, ostraka, etc. This is followed by the various biblical texts, including an interesting discussion about the reliability of the Old Testament as reflected in copies (when compared to the Qumran Scrolls) made in Jewish communities. The rest of the book traces the archaeological evidence as it relates to biblical history. A very short account of 'pre-Israelite' times covers Palestinian prehistory up to the Late Bronze Age. Ras Shamra is used as an example of the 'pre-Israelite' city, citing the various cultural influences in evidence there. With Chapter VI begins the history of the Israelites: the Age of the Patriarchs (VI), Infiltration of the tribes into Canaan (VII), etc., up to the Second Jewish Revolt (XII). Bardtke takes place-names mentioned in biblical accounts and presents the evidence for or against their identification with sites in Palestine today: a very compelling account, in which he always retains scholarly integrity while at the same time writing in an informal, sometimes almost conversational, style. He makes use of the most recent excavation reports throughout.

In conclusion Bardtke reiterates that his book is not an Apologia and that 'archaeology cannot awaken beliefs' nor is Christian belief dependant upon the results of 'Spatenforschung' but that the believing Christian may be interested in the results of historical Bible-critique and archaeology as through them the fact of the origin of the biblical 'Gotteszeugnis' in actual history, in this world is attested.

An excellent work with only one shortcoming: illustration. Better use could have been made of the available photographs and drawings, especially in such areas as ceramic evidence. Also a contour map in conjunction with a discussion of topography (with respect to distribution of fortified cities, trade routes, etc.) upon which so much of the history in Palestine has always depended, could have been useful. There is an appendix with a time chart, an extensive bibliography, an index and two fold-out maps.

S. W. HELMS

The following books have been received. The fact that they are listed here does not preclude their review in a later issue:

ALP, S.	Zylinder- und Stempelsiegel aus Karahöyük Turk Tarih Kurumu, 1968	
ASHE, GEOFFREY	The Quest for Arthur's Britain Pall Mall Press, 1968	70s.
BRAY, W.	Everyday life of the Aztecs Batsford, 1968	25s.
CROWTHER,	Bibliography of early Russian history Blackwell, 1969	
GRINSELL, W. F.	Prehistoric Bristol	
MULVANEY, D. J.	The prehistory of Australia Thames & Hudson, 1969	42s.
ÖZGÜC, N.	Seals and seal impressions of level Ib from Karum Kanesh Turk Tarih Kurumu, 1968	
PHILLIPS, E. D.	The Mongols Thames & Hudson, 1969	42s.
SANDARS, N. K.	Prehistoric art in Europe Penguin Books, 1968	126s.
WHEELER, R. E. M.	Early India and Pakistan, Rev. ed. Thames & Hudson, 1968	42s.
WILLIAMS, J. C. C.	Simple Photogrammetry Academic Press, 1969	50s.

UNIVERSITY OF LONDON

INSTITUTE OF ARCHAEOLOGY

twenty-fifth
ANNUAL REPORT

1 August 1967 — 31 July 1968

INSTITUTE OF ARCHAEOLOGY

COMMITTEE OF MANAGEMENT

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Professor P. E. Corbett
Professor W. B. Emery
Professor C. Daryll Forde*
Professor R. A. Humphreys
Sir Peter Noble
Professor W. Watson
(*Two vacancies*)

Two members of the non-professorial staff nominated by the non-professorial staff through the Academic Board:—
Mr. P. J. Parr
Dr. J. d'A. Waechter

The four Professorial Heads of Department of the Institute (*ex officio*):—
Professor G. W. Dimbleby*
Professor J. D. Evans
Professor R. G. Goodchild
Professor S. H. F. Lloyd

Five other persons:—
Mr. R. L. S. Bruce-Mitford
Professor J. G. D. Clark
Mr. A. R. Dufty
Sir Eric Fletcher
Professor D. McKie

Sir Peter Noble acted as Chairman throughout the session.

In view of his impending retirement Sir Peter expressed a wish to resign from the Committee, which has placed on record its appreciation of his services over a number of years as a member and more recently, as Chairman.

*Members of the Financial Sub-Committee

PROFESSOR D. MCKIE

The Committee records with regret the loss of Professor McKie, a member since 1958, who died in August.

REPORT OF THE DIRECTOR FOR THE SESSION 1967/68

ADMINISTRATION

Director: Professor W. F. Grimes, C.B.E., M.A., D.Litt., F.S.A., F.M.A., (*A.T.*)*

Secretary and Registrar:	E. Pyddoke, F.S.A.
Director's Secretary:	Mrs. M. Hunt
Senior Administrative Assistant	Miss J. V. Brown
Administrative Assistants:	Miss T. S. Halbert
	Miss S. E. Johnson

Staff matters

PROFESSOR R. G. GOODCHILD

The death of Professor Goodchild in February was an unexpected blow. He had quickly established himself in the Institute and will be remembered by all who knew him both within his department and outside it, for his unfailing helpfulness and kindness. Professor Goodchild took up his appointment in October after a distinguished career in North Africa, but he was a scholar of wide attainments whose sudden death has left a sad gap in more than one field. A Libya Committee has been set up under the chairmanship of Professor A. H. M. Jones of Cambridge 'to propose and co-ordinate a programme of work in Libya to complete projects left unfinished by Professor Goodchild'.

The Director continued to serve as Chairman of the Royal Commission on Ancient Monuments in Wales and Monmouthshire and as a member of the Royal Commission on Historical Monuments (England), the Ancient Monuments Boards for England and for Wales, and the special Committee set up by the Minister of Public Building and Works to report on the future of field monuments in Britain. He was also Chairman of the Field Studies Council, Council for British Archaeology Committees on Ancient Agriculture and Industrial Archaeology, the London Topographical Society, the Deserted Medieval Villages Research Group and of research committees set up to advise on the scientific and archaeological implications of the establishment of the Peterborough and Milton Keynes new towns. He continued to act as Honorary Treasurer of the Council for British Archaeology. He also served on the Italian Art and Archives Rescue Fund.

Dr. D. E. Strong was appointed to the Chair of the Archaeology of the Roman Provinces to take up the appointment in September, 1968.

Mr. Mellaart's appointment was converted from part-time to full-time.

Mr. Mark Hassall, who had carried much of the responsibility for the work of the Department of the Archaeology of the Roman Provinces before Professor Goodchild's appointment and after his death, was appointed Lecturer as from 1st October, 1968.

Dr. Bray, Miss Gedye, Mr. Nandris, Miss Parker and Mr. Stewart were appointed Recognised Teachers of the University.

**A.T.* Appointed Teacher, *R.T.* Recognised Teacher of the University of London, throughout.

Miss J. M. Sheldon (Human Environment) was awarded the B.Sc. in Geography in July.

Professor Evans and Dr. Hodson were elected Corresponding Members of the German Archaeological Institute.

Mr. Mellaart and Mrs. Maxwell-Hyslop attended the VI International Congress of Iranian Art and Archaeology at Teheran in April, after which they visited archaeological sites in the Zagros mountains. Mr. Mellaart also took part in a seminar on the 'Origins of Civilisation' held under the auspices of the School of American Research at Santa Fé, New Mexico, in March.

Miss Gedye and Mr. Hodges attended the London Conference on Museum Climatology of the International Institute for Conservation. Miss Gedye continued as Secretary of the United Kingdom Group of the International Institute for Conservation. Mr. Hodges continued to serve as Recorder to Section H of the British Association.

Visiting Scholars

Among scholars who visited the Institute were Mr. D. Barag and Dr. G. Foerster (Hebrew University, Jerusalem).

Public Lectures and Exhibitions

Because of a combination of personal and professional pressures, Dr. C. F. A. Schaeffer found himself unable to give the Special University Lectures in Archaeology for 1967–8.

Fifteen public lectures were given during the session, including a course of six lectures, under the joint auspices of the Committee for Nautical Archaeology and the Institute, on 'Sources of maritime archaeology', the speakers being Lt. Cdr. D. W. Waters, R.N., Mr. I. P. Joliffe, Mr. G. P. B. Naish, Miss E. Vollans, Mr. B. Greenhill and Mr. D. Leigh. The remaining lectures were given by Dr. V. Nekuda and Mr. V. Hank (Moravian Museum, Brno), Dr. V. Seton-Williams, Emir Chéhab (Director General of Antiquities, Lebanon), Dr. W. Bray and Professor W. G. Solheim (Chairman, Far-Eastern Prehistory Association).

Four lectures were given under the joint auspices of the Institute of Classical Studies and the Institute by Mr. E. Heliopoulos, Professor W. den Boer (Leiden), Dr. V. Kharageorghis (Department of Antiquities, Nicosia) and Dr. P. Warren (Corpus Christi, Cambridge).

Attendances averaged 55.

Exhibitions mounted included one illustrating work on deserted medieval villages in Czechoslovakia, staged to coincide with the lecture given by Dr. Nekuda and Mr. Hank; an exhibition illustrating 100 years' work of the Palestine Exploration Fund; and the annual display of work undertaken by students in the Photographic Department.

The Institute continued to co-operate with the Extra-Mural Department in teaching for the University Extension Courses leading to the Diploma in Archaeology. A number of courses were again held in the building and among the lecturers at the

Institute and elsewhere were a number of past and present students of the Institute. The Director and Mr. Parr acted as external examiners for the Diploma. Professor Dimbleby, Professor Evans, Mr. H. M. Stewart and Dr. J. G. Evans gave special lectures on behalf of the Extra-Mural Department.

Students

The total number of students registered at the Institute during the session was 140; in addition 55 Intercollegiate students attended courses. Institute students included 27 who were registered for Diplomas (1 part-time); 57 for Higher Degrees (4 part-time); 25 for the course in Archaeological Conservation (5 part-time); and 8 for the course in the Conservation of Historical Monuments (1 part-time). Four full-time and 19 part-time Occasional students attended lectures and used the facilities of the Institute.

Four students were awarded the Diploma in European Archaeology, two in Section B1 (Iron Age and Roman Provinces) and two in Section B2 (The British Isles in the Anglo-Saxon Period); two the Diploma in Prehistoric Archaeology; and two the Diploma in the Archaeology of Western Asia (A: Mesopotamia).

Of the 57 Higher Degree students, 22 were registered for the Ph.D. full-time (two in the faculty of Science) and two part-time. Thirty-five were registered for the M.Phil. and M.A. (Old Regulations) full-time and two part-time. Ph.D.'s were awarded to Miss M. B. Bender (Prehistoric Department) in January and Miss S. Limbrey (Department of Human Environment) in March and an M.Phil. to Mr. G. Danisman (Department of Western Asiatic Archaeology) in June.

Eight students qualified for the Institute's Diploma in Conservation and one for the Diploma in the Conservation of Historical Monuments.

Nineteen countries were represented by 61 students registered at the Institute as follows: Aden, 1; Australia, 3; Canada, 1; Denmark, 2; France, 1; Greece, 5; India, 3; Israel, 1; Korea, 1; Lebanon, 3; Netherlands, 1; New Zealand, 3; Poland, 1; South Africa, 1; Sweden, 2; Tanzania, 1; Trinidad, 1; Turkey, 3; U.S.A., 27. In spite of the increase in fees for overseas students, the number continues to increase.

Mr. Lawrence Keen, reading for the Academic Postgraduate Diploma in Anglo-Saxon Archaeology, was awarded the British Archaeological Association's Reginald Taylor Prize for his essay on 'A series of 17th–18th century lead-glazed relief tiles from North Devon'.

The prospect of having first-degree students joining the Institute for the next session led to the formation of a Students' Union during the summer term. The Union, which was properly constituted and affiliated to the University Union, elected the following officers to serve in the coming session:

President: D. Price-Williams (Department of Western Asiatic Archaeology)
Treasurer: B. J. H. Clauson (Department of the Archaeology of the Roman Provinces)
Secretary: Miss Mary E. H. Dyk (Conservation Department)

Gordon Childe Prize and Bequest Fund

Gordon Childe Prizes for 1967/68 were awarded to Miss S. Limbrey (Department of Human Environment) and Mr. A. Mturi (Prehistoric Department).

The income from the Gordon Childe Bequest Fund for the session was applied to the purchase of equipment urgently needed by the Institute.

Margary Fund

Twelve students received awards to enable them to travel in Greece, Cyprus, Malta, Ethiopia, Iran, Turkey and Britain.

TRAINING AND RESEARCH

Institute Field Course

The Institute's field-course was again held in North-east Yorkshire at the end of the summer term and dealt with both environmental and archaeological matters. A number of teachers took part in the course, which was under the general direction of the Director and Professor Dimbleby. The thanks of the Institute are due to Mr. T. C. M. Brewster, Mr. R. Hayes and Mr. T. G. Manby for making available to the course their knowledge of local archaeological sites.

Research Seminar in Archaeology and Related Subjects

This was another very successful year for the Research Seminar, which held four meetings before the end of December. The variety of topics covered speaks for itself:

17.10.67 'The publication of archaeological reports'

Paper by: Mrs. S. L. Humphreys (Warburg Institute)

Chairman: Mr. L. V. Grinsell (City Museum, Bristol)

7.11.67 'Trade and culture process in European prehistory'

Paper by: Dr. Colin Renfrew (University of Sheffield)

Chairman: Dr. I. H. Longworth (British Museum)

28.11.67 'The archaeologist and field systems'

Paper by: Mr. C. C. Taylor (Royal Commission on Historical Monuments (England)

Chairman: Dr. John Alexander (Department of Extra-Mural Studies)

15.12.67 'Some new ideas on excavation'

Paper by: Dr. Martin Biddle (All Souls College, Oxford) and Dr. Birthe Biddle (University of Aarhus)

Chairman: Professor R. G. Goodchild (Institute of Archaeology)

As at previous meetings participants stressed the unique and important role of this Seminar as a forum for interdisciplinary discussion.

No meetings were held at the beginning of 1968 as organisation of the two-day Seminar was under way. This took place on May 18th/19th to discuss 'The domestication and exploitation of plants and animals', and was attended by more than 100 scientists and scholars from many parts of the world. This was probably the first time that Domestication has been discussed from all the different points of view of the various disciplines concerned—botanical, zoological, ethnographic and archaeological. The papers delivered to this Seminar, revised by the authors in the light of discussions, together with several further contributions offered by participants at the Seminar meetings are now in press and will be published in April, 1969 by Duckworth Press.

The thanks of the Institute are due to Professor Dimbleby, Dr. P. J. Ucko of University College and Miss Susan Johnson for their work in the organisation of the Seminar. The two-day Seminar, involving as it did an immense amount of administrative work for many weeks beforehand and, since, considerable editorial work in connection with the publication, cast heavy burdens on people already fully engaged and the considerable success of the event reflects directly on their efficiency and dedication.

Underwater Research Group

Only three meetings were held during the year, because of the numerous public lectures on underwater research which took place during the session. Ten students became regular members and two completed their bath training as divers.

Miss Wylde, President of the Group, joined Dr. Michael Katzef's team on the excavation of the 4th century B.C. wreck at Kyrenia, Cyprus, during the vacation.

The opening meeting was held on November 1st, when films were shown, followed by a social gathering; 30 students were present. At the second meeting on December 13th future activities were discussed and the group entertained the Mensura Diving team led by Mr. Wilkes, who showed a film of the team's exploration of Tharros in Sardinia. On January 24th Mr. Paul Johnstone showed the B.B.C. film of Dr. Bass's Expedition to Yassi, with a commentary by himself and M. Claud Duthuit, a member of the expedition.

Outside meetings in which the Group participated included an IIC meeting on the conservation of objects taken from the sea (30 Nov.); an evening conference on underwater photography at Imperial College (12 Jan.); and a meeting of Malta Underwater Association at the Zoo (morning session on underwater archaeology) (21 Mar.).

Miss Taylor continued to accept general responsibility for the work of the Group.

THE DEPARTMENTS

The Director again served as External Examiner for Nottingham University and continued to act as adviser to a research student of Reading University. His advisory work in connexion with the ancient defences of London in the Barbican area of the City continued and he completed the excavation of the site of the church of St. Mary Aldermanbury.

He gave a number of outside lectures.

The following student continued to work under the Director's supervision.

M.Phil.

E. M. Holt, Miss (Faculty of Arts): Study of ancient fields (medieval) with specific reference to early estate maps in the Pennine District.

Publication:

The Excavation of Roman and Mediaeval London, Routledge and Kegan Paul 1968, 261 pp.

HUMAN ENVIRONMENT

Professor:	G. W. Dimbleby, B.Sc., M.A., D.Phil. (Oxon.) (*A.T.*)
Reader:	I. W. Cornwall, Ph.D. (*A.T.*)
Research Assistants:	J. G. Evans, Ph.D.
	M. C. D. Speight, Ph.D.
Assistant:	Miss J. M. Sheldon, B.Sc.
Chief Technician:	P. Porter
Technician:	G. Sansom
Honorary Assistant:	Mrs. M. Barton

Four students continued their Ph.D. studies during the year, namely:

Ph.D.

C. Banks, Mrs. (née Grigson) (Faculty of Science): Prehistoric cattle remains from Europe and India.

A. Kosse (Faculty of Arts): Pedological investigation of settlement sites (joint registration with Professor Evans).

S. Limbrey, Miss (Faculty of Science): A study of the effect of climatic differences on soil formation on basalt in the Canary Islands and the British Isles.

D. Mathewson (Faculty of Arts): Weathering processes on archaeological objects.

Miss Limbrey completed her work during the year and was awarded her doctorate.

In addition to these students, Mr. John Hollin was working in the department as part of his course for the Ph.D. at Princeton University; and Mr. Hilary Deacon spent the year here studying techniques and literature for application to his work in South Africa.

The lectures for the Diploma courses followed the usual pattern, but in addition a series of seminars was run to illustrate the correlation to be achieved between the

archaeological investigation and the results of various environmental investigations on the same site. The site discussed was the long barrow at South Street, near Avebury, excavated by Dr. John Evans.

Dr. Evans and Dr. Speight continued their research into, respectively, the Mollusca and the Insecta from archaeological sites, which they are carrying out on N.E.R.C. research assistantships.

Dr. Cornwall spent three months' leave-of-absence, from January to March inclusive, in Mexico, where he continued his research and fieldwork, begun in 1964, on a stratigraphical study of late Pleistocene volcanic sediments, and the various buried soils developed among them, along the new motorway between the cities of Mexico and Puebla. This study is aimed at providing a partly relative and partly absolute chronological 'bridge' between the Mexico-Basin early-man site of Tlapacoya and those in the Puebla Valley near the Valorquillo Reservoir. Results will be published in two parts in English in the next two numbers of the Institute's *Bulletin* and as a monograph, in Spanish, by the Dpto. de Prehistoria, Instituto Nacional de Antropologia e Historia, in Mexico.

Other research investigations were made on sites of widely different ages, both in this country and abroad. The Department continues to build up reference material and again acknowledges the help given by the University Botanical Supply Unit.

Publications:

By Professor Dimbleby:

'The Chambered Cairn and adjacent monuments on Great Ayton Moor, N.E. Yorks. Appendix C—Pollen Analysis. Appendix D—Charcoals', *Scarborough and District Arch. Soc. Res. Rep.* No. 7 (1967), 39–43.

'The Priddy Circles, Mendip, Somerset Henge Monuments. Appendix 1—Pollen Analysis', *Proc. Univ. Bristol. Spelaeol. Soc.* 11(2) (1967), 121–2.

'Plant remains as evidence of prehistoric land use', *Medic. and Biol. Illustration*, 18(2) (1968), 128–134.

By Dr. Cornwall:

'A double Beaker-burial on Bredon Hill, Worcs. The Skeletons', *Trans. Birmingham Arch. Soc.*, 82 (1967), 72–5.

'Fact and fiction surrounding a religious relic', *Medic. and Biol. Illustration*, 18(2) (1968), 135–7.

Prehistoric Animals and their Hunters, Faber 1968, 214 pp.

By Dr. Evans:

'Plough-marks, lynchets and early fields' (with P. J. Fowler), *Antiquity* 41 (1967), 289–301.

'Excavating two long barrows in North Wiltshire' (with I. F. Smith), *Antiquity* 42 (1968), 138–142.

INDIAN ARCHAEOLOGY

One student was registered for the Ph.D. as under; Dr. F. R. Allchin of Cambridge University kindly continued to supervise the work of this student.

A. C. Pal (Faculty of Arts): Protohistoric studies in the Deccan.

PREHISTORIC ARCHAEOLOGY

Professor: J. D. Evans, M.A., Ph·D., F.S.A. (*A.T.*)
Lecturers: F. R. Hodson, M.A., Ph.D., F.S.A. (*R.T.*)
J. d'A. Waechter, M.A., Ph.D., F.S.A. (*R.T.*)
Lecturer in Latin American Archaeology: W. M. Bray, Ph.D., M.A. (joint post with Institute of Latin American Studies) (*R.T.*)
Assistant Lecturer: J. Nandris, B.A. (*R.T.*)
Special Lecturer: T. Sulimirski, Iur.D., Ph.D. (Lwow), Hon. F.S.A.
Honorary Assistant: Mrs. B. Kulesza

There were nine full-time students and one part-time student registered for the Postgraduate Diploma at the commencement of the Session. Three of the full time students were in their second year. Of these, two successfully sat the examination in June and were awarded the Diploma. The third withdrew.

Teaching was also provided for one occasional student and 23 inter-collegiate students.

Twenty-three students were registered for higher degrees in the Faculty of Arts, as follows:

Ph.D.

M. B. Bender, Miss: The Neolithic cultures of north-west France.

D. C. Biernoff: An analysis of the earliest painted design motifs on pottery from Western Anatolia and Greece.

I. M. Crawford: Late prehistoric changes in aboriginal cultures in Kimberley, Western Australia.

C. Doumas: Cemeteries and burial customs in the Cycladic Islands during the early Bronze Age.

A. D. Kosse: Pedological investigation of settlement sites (joint registration with Professor Dimbleby).

R. R. Newell: The acculturation of the Mesolithic Hunter-Fishers by the intrusive Neolithic civilisation in Western Europe.

A. P. Phillips, Miss: (Field of proposed research) The Relationship of the Chassey and Lagozza cultures in South-East France.

M. G. Spratling: Aspects of metalwork in Southern Britain in the first century B.C. and the first half of the first century A.D.

G. Watling, Mrs. (*née* Putt): The Late Bronze Age cultures in Southern Britain.

M.Phil. and M.A. (*Old Regulations*)

I. Azoury, Mrs.: (Field of proposed research) The Transitional Period relevant to the prehistoric archaeology of Western Asia, either the Upper Palaeolithic, or the Mesolithic, or the Neolithic Period.

E. Bader: (Field of proposed research) Levantine influences in the Early and Middle Bronze Ages in the Aegean basin (joint registration with Mr. Parr).

G. H. A. Bankes: The archaeology of the North Coast of Peru, particularly the Moche pottery style.

B. M. Beeby (*part-time*): La Tène Cultures of the Carpathian Basin with particular attention to trade and economy.

G. P. Diamond: Neolithic Crete and the connections with the Greek mainland.

C. Dortch: A typological analysis of some post-Aurignacian levels from the site of Ksâr 'Akil.

N. P. Evans, Mrs. (*née* Figgis): The development of the early British Neolithic with special reference to the Western Province.

I. Harrison, Mrs. (*née* Haglund): Connections between Scandinavia, Russia and the British Isles from the Neolithic to the Early Iron Age.

J. W. Haldane: The study of iron-work from pre-Roman sites in the south-west of England (joint registration with Mr. Hodges).

M. Lev: A metrical analysis of earlier stone age hand-axes from east and north Africa—a development and comparative study.

A. McCord, Miss: (Field of proposed research) An examination of the relationships between the Levallois technique and the Acheulean industries of southern Britain.

M. H. Newcomer: An analysis of a series of burins from Ksâr 'Akil (Lebanon).

T. P. O'Brien: The Sangoan complex of sub-Sahara Africa.

F. F. Petersen: The Neolithic and Bronze Age of east Yorkshire.

W. W. Phelps: The Neolithic sequence in southern Greece.

V. N. Rana-Sisodia: The evolution of the Palaeolithic in India.

R. C. Reed: A survey of Cornwall in the Neolithic and Bronze Age with a special section concerning the trade in Cornish stone axes.

M. J. Rowlands: The metallurgy of the Middle Bronze Age in Britain.

Miss Bender was awarded the degree of Ph.D. in January.

Professor Evans continued to serve as External Examiner at the Queen's University, Belfast and gave a number of outside lectures.

Dr. Bray spent the summer of 1967 visiting sites and studying museum collections in several Latin American countries, part of the time as guest of the Instituto Nacional de Antropologia e Historia, Mexico. He also gave two courses of lectures for the University of Sheffield and served as an Examiner there, as well as giving a number of public lectures.

Dr. Hodson continued on leave-of-absence during the first term, his Atlas Senior Research Fellowship in the Use of Computers in the Sciences and Arts having been

extended. He presented some preliminary results of this work to the Biometrics Society on 7th December, 1967. He also served as External Assessor for the Anglo-Saxon Tripos at Cambridge.

Dr. Waechter carried out a two month excavation at Swanscombe as part of an extended investigation of this important palaeolithic site.

Mr. Nandris served on the Committee for the Prehistoric Society Conference on the archaeology of the Middle and Lower Danube Basin and read a paper. He also lectured at Cambridge in February. During the Summer of 1968 he assisted in excavation and survey work in the Djerdag area of the Danube carried out by Yugoslav archaeologists, and subsequently toured Museums in Serbia, Macedonia and Dalmatia.

Publications:

By Professor Evans:

Excavations at Saliagos near Antiparos (with Dr. A. C. Renfrew): British School at Athens Supplementary Vol. 5 (1968), 226 pp.

'Malta in Antiquity', *Blue Guide to Malta*, 1968, 9–28.

'Excavations at Saliagos, 1964', *ΑΡΧΑΙΟΤΛΙΚΟΝ ΔΕΛΤΙΟV* 45 (1965), 525–6.

Various reviews.

By Dr. Bray:

'The Cauca Valley Expedition, 1964', (with J. L. W. Robinson and A. R. Bridgeman). *Explorer's Journal* XLIV March, 1968, 43–50.

Everyday Life of the Aztecs, B. T. Batsford/G. P. Putnam's Sons 1968, 208 pp.

Various reviews.

By Dr. Hodson:

Abstract of lecture to Biometrics Society, 7th December (1967), *Biometrics* 24 (1968), 227.

By Mr. Nandris:

'Lepenski Vir' *Science Journal*, January, 1968, 64–70.

ARCHAEOLOGY OF THE ROMAN PROVINCES

Professor: R. G. Goodchild, M.A., F.S.A., (*A.T.*) (deceased February, 1968).
Assistant Lecturer (temporary): M. W. C. Hassall, M.A.

There were 16 students in the Department, three of whom were registered for the Post-graduate Diploma, 11 for Higher Degrees (two part-time). Two occasional students attended Post-graduate Diploma courses. The two second-year Diploma students successfully took the examination in June. The lecture course on Roman Britain given by Professor Goodchild and completed by Mr. Hassall was attended by 25 intercollegiate students.

The following were reading for Higher Degrees, all in the Faculty of Arts:

Ph.D.

J. P. Alcock, Miss (*part time*): Food in Roman Britain.
M. W. C. Hassall: The *Notitia Dignitatum*.
W. H. Manning (*part-time*): Objects of Iron in Roman Britain.
S. E. Ramsden, Miss: Roman mosaics in Greece.
P. V. Webster: Romano-British pottery of the West and North Midlands.

M.Phil.

H. Chapman: Itineraries and Posting Stations.
S. K. Digby: Coin Reforms of Aurelian and its effects on Roman Britain.
R. Goodburn: A systematic survey of the development and history of the Roman villa in Britain.
J. C. Hanson, Miss: Water supply in Roman Britain.
H. R. Hurst: Roman villas in the Bath area.
M. Roxan, Mrs.: The Auxilia of the Roman Army.

Professor Goodchild gave a paper to the Roman Society in January.

Mr. Hassall directed excavations at Cirencester at Easter and also assisted in the University of Long Island's excavations at Knidos in July and August, later visiting sites in western Turkey.

WESTERN ASIATIC ARCHAEOLOGY

Professor: Seton Lloyd, C.B.E., M.A., F.B.A., F.S.A., A.R.I.B.A. (Retd.) (*A.T.*)
Lecturer in Mesopotamian Archaeology: Miss Barbara Parker, O.B.E., F.S.A., (*R.T.*)
Lecturer in Palestinian Archaeology: P. J. Parr, M.A., F.S.A. (*R.T.*)
Lecturer in Anatolian Archaeology: J. Mellaart, B.A., F.S.A.
Seminar in Metallurgy and Metal Typology: Mrs. K. R. Maxwell-Hyslop, F.S.A. (*R.T. Retd.*)

The number of full-time students in the Department was 24, of whom nine were reading for the Post-graduate Diploma in the Archaeology of Mesopotamia, one in Palestinian Archaeology and one Anatolian Archaeology. There were 13 students in the Department reading for higher Degrees, four in the Archaeology of Mesopotamia (one part-time), six of Palestine and three of Anatolia. There was one full-time Occasional student and one intercollegiate student reading for the M.Th. degree at King's College under Palestine.

Two students were successful in the examination for the Diploma in Mesopotamian Archaeology.

Students registered for Higher Degrees in the Faculty of Arts were as follows:

Mesopotamia

Ph.D.

E. D. Caspers, Mrs: Archaeological evidence for Maritime Trade in the Persian Gulf in the 3rd millennium B.C.

M.Phil. and M.A. (*Old Regulations*)

E. R. Jewell, Miss: Bronze Age Anatolia with special reference to probable interrelationships with adjoining area.
P. Razavi, Miss: Achaemenid art in the Western Provinces.
D. S. Noble (*part-time*): The development of transport in ancient Mesopotamia.

Palestine

Ph.D.

E. Oren: The Bronze Age cemeteries of Beth Shan.
H. Seeden, Miss: The Phoenician standing deity or warrior figurines and related types during the second millennium B.C.

M.Phil. and M.A. (*Old Regulations*)

V. Izon, Miss: Archaeological evidence for the period of the Judges.
D. Price Williams: Archaeological evidence for Israelite religion.
M. Sagieh, Miss: Byblos in the third millennium.
G. L. Smith, Miss: (Field of proposed research) Archaeology of Palestine and Syria.

Anatolia

M.Phil.

W. M. N. Campion: The relations between Anatolia and neighbouring countries in the second millennium.
G. Danisman: Anatolian architecture up to the Persian Conquest.
O. Bilgi: Anatolian archaeology in the Bronze Age.

G. Danisman presented his thesis in June and was awarded an M.Phil.

The Professor took part in an advisory capacity in the first season's excavations conducted by Mr. C. A. Burney at Haftavan in Persian Azarbaijan. He also visited British teams participating in the Keban Dam rescue operation in central Turkey.

Miss Parker was granted leave-of-absence in the Spring to join the excavations of the British School of Archaeology in Iraq at Tell al Rimah.

During the spring, Mr. Parr in collaboration with Mr. G. Lankester Harding and Mr. John Dayton, carried out an exploration of archaeological sites in North-west Arabia, surveying those at which excavations might be practicable in the near future.

Early in 1968, on the initiative of Mr. Parr and Mr. Dayton, an 'Arabian Group' was founded, to further the prospects of archaeology in the Arabian peninsula. Two meetings of the Group have taken place.

A Seminar in Biblical Archaeology was inaugurated at the suggestion of Dr. M. Gertner and a first meeting took place in the summer term.

Dr. Clare Meade (*née* Goff) resumed her excavations at Baba Jan in Luristan, under the sponsorship of the Institute, and successfully completed a third season's work.

Mr. G. E. Turner, M.Phil., received a travel grant from the British School of Archaeology in Iraq, to continue his study of Assyrian palaces.

Publications:

By Professor Lloyd:

Early Highland Peoples of Anatolia, Thames and Hudson 1967, 144 pp.
Various reviews.

By Mr. Parr:

'The investigation of some inaccessible rock-cut chambers at Petra', *Palestine Exploration Fund Quarterly* 1968, 5–15.

'Origins of the rampart fortifications of the Middle Bronze Age in Palestine and Syria', *Zeitschrift des Deutschen Palastina-Vereins* 84 (1968), 18–45.

By Mr. Mellaart:

'Archaeomagnetic intensity measurements on some neolithic samples from Çatal Hüyük (Anatolia)' (with V. Bucha), *Archaeometry* 10 (1967), 23–25.

DRAWING AND SURVEYING

Lecturer: H. M. Stewart, B.A. (*R.T.*)

The number of students attending courses was:

Drawing: 40 (15 Diploma, 11 Conservation, 7 Higher Degree, 7 Occasional)

Surveying: 39 (15 Diploma, 13 Conservation, 8 Higher Degree, 3 Occasional)

A course of seven lectures on Archaeological Surveying and Drawing was given in the Department of Extra-Mural studies.

The completion of drawing of inscriptions from the temple at Semna East was undertaken by Mr. Stewart for the Egypt Exploration Society's Archaeological Survey.

Publications:

By Mr. Stewart:

'Stelophorous statuettes in the British Museum,' *Journal of Egyptian Archaeology* 53 (1967), 34–38.

'The mythical Sea of Knives', *Journal of Egyptian Archaeology* 53 (1967), 164.

PHOTOGRAPHY

Visiting Lecturer: S. K. Matthews
Senior Technician: Mrs. M. V. Conlon

Forty students attended the course: 20 Conservation, 18 Diploma and two part-time students.

As in the past, the Department advised and assisted in a variety of ways organisations and individuals engaged in archaeological projects. An example was the Department of Anatomy of the University of Chicago. A member of the department's expedition to South Africa was given an intensive course, and its chief photographer, Mr. D. Parish (a former student of the Institute) was afforded facilities to complete his work, which included photographs for an exhibition for the South African Natural History Museum in Cape Town.

The Department continued to develop specialised techniques of value for archaeological research. Recent additions to the equipment included a microscope for photomicrography which is of particular value for archaeological conservation.

The annual exhibition of photographs was held in July. In addition to the second year Conservation students, Diploma students also exhibited. Photographs were lent for the London Classical Association's 'Hellas' exhibition and to the Stoke-on-Trent Museum.

In the summer vacation 1967 Scotland Yard kindly gave permission for the Department's technician to visit their photographic sections where problems of interest to both parties were discussed.

Mr. D. Plunket Green served as photographer to the Sheffield University excavation at Photolivos in northern Greece.

Publications:

By Mr. Matthews:

Photography in Archaeology and Art, John Baker 1968, 161 pp.

By Mrs. Conlon:

'Aspects of Photography in Archaeological Research', *Medic. and Biol. Illustration* XVIII, 2 (April, 1968), 138–143.

CONSERVATION

Senior Lecturer-in-Charge: Miss Ione Gedye, B.A., F.I.I.C. (*R.T.*)
Senior Lecturer: H.W.M. Hodges, F.I.I.C. (*R.T.*)
Technician: Miss P. Pratt
Honorary Assistant: Miss A. Plowden

Twenty-five students attended courses in the Department of whom 20 followed the Conservation course, seven being in their second year and six part-time.

Visitors who came to study pottery restoration included Mrs. Peter Smith and Miss Wendy Aldridge (British Institute of Archaeology at Ankara).

The Department's thanks are again due to Dr. A. E. Werner, Keeper of the Research Laboratory of the British Museum, both for acting as external examiner and for help in other ways; and also to Mr. Baines-Cope of the same department for instruction in the technology, decay and conservation of paper.

As in previous years, work of instructional value to students was undertaken for a number of museums and institutions.

Miss L. Bacon, Mr. J. Baillie, Mr. S. Dove, Mr. H. Lange, Mr. G. Learmouth, Miss F. Roberts, Mrs. J. Rutter and Miss C. Souyouldjoglou obtained the Diploma in Conservation; Mr. G. Danisman also passed the examinations and submitted a satisfactory essay.

Miss Gedye and Mr. Hodges again lectured on the examination and conservation of pottery for an Extra-mural course. Mr. Hodges was invited to give a course on Conservation at the Middle East Technical University in Ankara. During his absence lecturing was covered by Mrs. A. Gardner, Miss V. Bird and Miss A. Plowden. He gave a week's course of lectures on conservation of metals at the Institut Royale de Patrimoine Artistique in Brussels.

At the invitation of the Kenya National Parks and supported by a grant from the Gulbenkian Foundation, Miss Pratt and Miss Plowden undertook the treatment of a 15th/16th century wall-painting at Fort Jesus, Mombasa; having been removed from its site, the painting was restored at the Institute and re-mounted at Fort Jesus in July.

At the invitation of the Hittite Museum, Ankara Miss Pratt carried out tests there for suitable methods of mounting mud plaster mural paintings.

Miss Plowden went on a fact-finding tour to the Far East and America, visiting a number of conservation laboratories.

The Department was asked to advise on the design and equipment of a Conservation Laboratory for the City Museum, Birmingham.

Four students went to Florence in the summer under the auspices of the Italian Art and Archives Fund to undertake conservation work in the Museo Archeologico the collections of which were seriously damaged in the floods of 1966. Other vacation work was carried out in Persia, Turkey and Greece and in Britain at Winchester, Dragonby, Sulgrave, North Uist; students also worked in the Ministry of Public Building and Works Laboratory in London.

Miss F. C. Roberts was awarded a Danish Government scholarship for research at the National Museum, Copenhagen.

CONSERVATION OF HISTORICAL MONUMENTS

Lecturer-in-Charge: (*part-time*) W. A. Eden, M.A., F.S.A., F.R.I.B.A. (Theory of Architecture. The Law relating to Ancient Monuments and Historic Buildings).

Lecturers: (*part-time*) R. A. Brown, M.A., D.Phil., F.S.A. (Documentary Sources for the History of Architecture in England. Public Records).

Mrs. M. P. G. Draper, B.A., F.S.A. (Documentary Sources for the History of Architecture in England. Local and Private Records).

Sir John Summerson, B.A., F.B.A., F.S.A. A.R.I.B.A. (English Architecture from 1540).

R. G. Wood, A.R.I.B.A. (Diagnosis and Treatment of Structural Faults in Buildings).

The Session was marked by continuing uncertainty regarding the financial provision for the course, following the Government's decision that no funds would be available to the University Grants Committee for new developments during the quinquennium 1967–72. This meant that the course had to be self-supporting and it became necessary to raise the tuition fees to £250 per annum, a figure that is beyond the financial resources of all but a very few students. The course could not have been kept in being had it not been for the co-operation of the Ministry of Public Building and Works and the Greater London Council in nominating appropriately qualified students for training at their expense. In the event the Ministry of Public Building and Works was not able to participate in the scheme during the Session 1967–68.

Eight students registered for the course (two second-year, five first-year and one occasional) of whom five were sponsored by the Greater London Council. Owing to the illness of Mr. Gilyard-Beer the course in English Architecture 597–1540 was suspended until the following session, when it was arranged that it should be taken by both first and second-year students. In order to assist in restoring the balance of the time-table first-year students were advised to attend a part of the course in the Law relating to Ancient Monuments and Historic Buildings.

Two candidates sat for the Diploma Examination and one was awarded the Diploma.

Visits were paid to the Masons' Yard and the Ironworks of the Ministry of Public Building and Works; Cobham Hill, Kent; Gunnersbury Park Temple; Chichester Cathedral; the Public Record Office; the Greater London Record Office; and to St. Paul's Covent Garden; the York Water Gate and the site of York House, St. Paul's Cathedral, etc.

LIBRARY

Librarian:	Miss J. du Plat Taylor, F.S.A.
Assistant Librarians:	Miss G. Talbot, M.A., A.L.A.
	Miss H. M. Bell, B.A.
Collections Clerk:	Miss J. Philips, B.A.

During the year work continued on the revision of the library classification and indexes. In order to meet an anticipated demand for additional seating consequent upon the institution of the first degree the reading room was modified by the removal of one book stack to provide eight more seats. The stack was re-erected in the ante-room and the necessary removal and re-organisation of books and periodicals carried out.

A student-librarian from Leeds, Miss Terry Tostevin, worked in the library during the session.

The Librarian continued to direct the excavations at Gravina, Italy on behalf of the Institute jointly with the British School at Rome.

The following is a summary of the additions made during the year:

Books		347	*Pamphlets*		439
Exchanged	63		Exchanged	34	
Presented	74		Presented	170	
Purchased	210		Purchased	235	
Periodicals		387	*Volumes bound*		313

Volumes lent totalled 4,667, the highest month being October (609) and the lowest August (145). Twenty-seven works were borrowed from outside libraries and fifty-five lent.

The following have presented books, periodicals and pamphlets:
Dr. P. B. Adamson; Albany Museum, Grahamstown; Dr. J. Alexander; Dr. M. H. Alimen; Mrs. Amiran; Dr. E. Anati; Society of Antiquaries of London; the Arts Council; Mrs. Baker; Miss H. Bell; Mrs. Bickerdike; Eduino Borges Garcia; Dr. W. Bray; the British Academy; the British Archaeological Association; British School of Archaeology, Iraq; Jean Chavaillon; Mrs. P. M. Christie; Prof. J. Desmond Clark; Peter A. Clayton; Colchester Museum; G. H. Cole; Mrs. Conlon; Dr. I. W. Cornwall; Dr. J. D. Cowen; Prof. G. W. Dimbleby; Dr. G. C. Dunning; Editor of *Endeavour*; Essex Field Club; Dr. Per Fett; Dr. Henry Field; F. Filce Leak; Ronald and Patricia Firman; Lady Fox; David H. French; Miss H. Fuller; P. S. Garlake; Miss I. Gedye; Goldsmiths' Librarian; Prof. W. F. Grimes; Museum Haaretz; Dr. D. B. Harden; David R. Harris; Mrs. G. Herrmann; Dr. C. F. W. Higham; H. W. M. Hodges; Hull Museum; Leo Imperatori; Mrs. Cynthia Irwin Williams; Iran Government (Ministry of Information); L. J. Keen; Kent County Council; Prof. Kiyoshi Ohata; A. D. Kosse; A. D. Lacaille; F. Lacorre; Fred Lake; Prof. D. M. Lang; Arthur L. Leach; J. Lepiksaar; Prof. J. L. Lorenzo; Robert F. Mark; R. J. Mason; Duncan Matthew-

son; Middle East Technical University (Ankara); V. N. Misra; T. C. S. Morrison-Scott; Prof. Hallam L. Movius; D. J. Mulvaney; John Nandris; Miss T. M. I. Newbould; Kyriakos Nicolaou; Tage Nilsson; Dr. K. P. Oakley; Eliezer D. Oren; Osrodek Documentacj i Zabytkow (Warsaw); Ora Patoharju; David Philips; Miss W. E. Phillips; M. W. Prausnitz; Ludwika Press; K. R. Robinson; D. J. A. Ross; Science Museum; Umakant P. Shah; Dr. T. C. Sharma; School of Oriental and African Studies; Wilhelm G. Solheim II; Dr. T. Sulimirski; Dr. A. J. Sutcliffe; Miss G. C. Talbot; Miss J. du Plat Taylor; University of Tokyo Institute of Oriental Culture; Miss O. Tufnell; Dr. G. Wainwright; National Museum of Wales; Dr. M. V. Seton Williams; G. R. H. Wright; National Museum of Zambia; Vlad Zirra.

STUDENTS' APPOINTMENTS

Mr. M. Abdulwahed: Director of Antiquities in the Government of the Republic of South Yemen.

Miss L. Bacon: Conservation Officer, Birmingham City Museum.

Mr. W. J. H. Baillie: Chief Conservation Officer, Underwater Excavations at Port Royal, Jamaica.

Mr. A. Butterworth: Deputy Director, Sheffield Museum.

Mr. J. Cross: Assistant Conservation Officer, Ministry of Public Building and Works Laboratory.

Mr. S. Deraniyagala: Assistant Commissioner (Excavations), Ceylon.

Miss J. Escritt: Conservation Officer, Bristol City Museum.

Mr. H. R. Hurst: Field Officer, Gloucester City Museum.

Mr. H. Lange: Conservation Assistant, Aarhus Prehistoric Museum, Denmark.

Mr. G. Learmonth: Conservation Officer, North-eastern Area Council.

Mrs. G. Pike: Assistant Curator, History Museum, Reading University.

Miss C. Roberts: Junior Assistant, Chester Museum.

Miss C. Souyouldjoglou: Conservation Officer, excavations at Ischia.

Mr. D. Noble: Lecturer in History, Whitelands College of Education.

UNIVERSITY OF LONDON

INSTITUTE OF ARCHAEOLOGY

Twenty-sixth
ANNUAL REPORT

1 August 1968 — 31 July 1969

INSTITUTE OF ARCHAEOLOGY

COMMITTEE OF MANAGEMENT

The Vice-Chancellor (Professor Sir Owen Saunders)

The Chairman of Convocation (Sir Charles Harris)

The Principal (Sir Douglas Logan)

The Director of the Institute (Professor W. F. Grimes)*

The Director of the Courtauld Institute of Art (or other representative) (Professor G. Zarnecki)

The Director of the Institute of Classical Studies (Professor E. W. Handley)

The Director of the Warburg Institute (Professor E. H. J. Gombrich)

The President of the Council for British Archaeology (or other representative) (Dr. D. B. Harden)

The President of the Prehistoric Society (or other representative) (Dr. J. D. Cowen)*

The President of the Society of Antiquaries (or other representative) (Sir Mortimer Wheeler)

Recognised or Appointed Teachers in cognate subjects, or Heads of Schools or Institutes in the University:—

Mr. J. G. Burton-Page
Professor P. E. Corbett
Professor W. B. Emery
Professor C. Daryll Forde*
Professor Eugénie Henderson
Professor R. A. Humphreys
Professor W. Watson
(*One vacancy*)

Two members of the non-professorial staff nominated by the non-professorial staff through the Academic Board:—

Mr. P. J. Parr
Dr. J. d'A. Waechter

The four Professorial Heads of Department of the Institute (*ex officio*)*:—*

Professor G. W. Dimbleby*
Professor J. D. Evans
Professor S. H. F. Lloyd
Professor D. E. Strong

Five other persons:—

Dr. R. L. S. Bruce-Mitford
Professor J. G. D. Clark
Mr. A. R. Dufty
Sir Eric Fletcher
(*One vacancy*)

Sir Eric Fletcher acted as Chairman throughout the session.

*Members of the Financial Sub-Committee

REPORT OF THE DIRECTOR FOR THE SESSION 1968/69

ADMINISTRATION

Director: Professor W. F. Grimes, C.B.E., M.A., D.Litt., F.S.A., F.M.A. (*A.T.*)*

Secretary and Registrar:	E. Pyddoke, F.S.A.
Director's Secretary:	Mrs. M. Hunt
Senior Administrative Assistant:	Miss J. V. Brown
Administrative Assistants:	Miss T. S. Halbert
	Miss S. E. Johnson

Staff matters

The Director continued to serve as Chairman of the Royal Commission on Ancient Monuments in Wales and Monmouthshire and as a member of the Royal Commission on Historical Monuments (England), the Ancient Monuments Boards for England and for Wales and the special Committee set up by the Minister of Public Building and Works which has reported on the future of field monuments in Britain. He continued as Chairman of the Field Studies Council, Council for British Archaeology Committees on Ancient Agriculture and Industrial Archaeology, the London Topographical Society, the Deserted Medieval Villages Research Group, the Nene Valley Research Committee concerned with the scientific and archaeological implications of Peterborough New Town and the Milton Keynes Committee concerned with similar problems in Buckinghamshire. He continued to act as Honorary Treasurer of the Council for British Archaeology and as a member of the Italian Art and Archives Rescue Fund.

Professor Seton Lloyd retired at the end of the session and was granted the title of Professor Emeritus.

Professor Lloyd was appointed to the Chair of the Archaeology of Western Asia in October 1962, after a distinguished career as Director of the British Institute in Ankara. He guided his department through years of change and expansion since then and during his time at the Institute made important contributions to publications in his field.

Mr. E. E. D. M. Oates, Director of the British School of Archaeology in Iraq, was appointed to succeed Professor Lloyd.

Professor D. E. Strong was appointed Chairman of the newly formed Libya Exploration Society.

Miss J. M. Sheldon was appointed a Lecturer in the Department of Human Environment.

Mr. M. W. C. Hassall and Miss J. M. Sheldon were appointed Recognised Teachers of the University.

Mr. D. Sturdy, M.A., B.Litt., joined the Institute in April from the University of Liverpool to take up a Hayter Lectureship (held jointly with the School of Slavonic and East European Studies) in the Medieval Archaeology of Russia and East Europe.

**A.T.* Appointed Teacher, *R.T.* Recognised Teacher of the University of London, throughout.

Mr. M. W. C. Hassall was appointed to represent the Institute on the Chelmsford Excavation Committee.

In July Miss Parker represented the Institute at the 18th Rencontre Assyriologique Internationale at Brussels.

Mr. J. G. Nandris was awarded the degree of Ph.D. by the University of Cambridge in January.

Dr. J. G. Evans, a Research Assistant in the Department of Human Environment, whose appointment was made possible by a grant from the Natural Environmental Research Council, has resigned to take up an appointment as Archaeological Officer to Buckinghamshire County Council.

Visiting Scholars

Among scholars who visited, and worked in, the Institute was Professor Won Yong Kim (University of Seoul), Mr. Louloupis (Cyprus), Mr. Savov (Bulgaria) and Dr. M. Tosi (University of Rome).

Public Lectures and Exhibitions

The Special University Lectures in Archaeology were given at the end of October/ beginning of November by Professor Gordon R. Willey of Harvard University. He took as his subjects 'Recent Archaeological Investigations at Seibal, Guatemala' and 'Recent Developments in American Archaeology'. Attendances averaged 44.

Seven other public lectures were given during the session. The speakers were Mr. Mansel Spratling, Dr. Colin Renfrew (University of Sheffield), Professor W. Watson (School of Oriental and African Studies), Dr. M. Tosi (University of Rome), Miss Maria Reiche, Professor Cambitoglou (University of Sydney) and Lord William Taylour. Dr. Renfrew's lecture was given jointly with the British School of Archaeology at Athens, Lord William Taylour's and Professor Cambitoglou's jointly with the British School and the Institute of Classical Studies. Attendances averaged 77.

Exhibitions mounted included the display of two reed boats brought back to this country by Mansel Spratling, an Institute student, who took part in the Great Abbai Expedition to the Ethiopian reaches of the Blue Nile, and the annual display of work by students in the Photographic Department.

The Institute continued to co-operate with the Extra-Mural Department in teaching for the courses leading to the University Extension Diploma in Archaeology. Several courses were again held in the building and the lecturers here and elsewhere included past and present students of the Institute. The Director and Mr. P. J. Parr continued to act as External Examiners. Other Extra-Mural lectures were given by Professor J. D. Evans, Professor G. W. Dimbleby, Miss J. M. Sheldon, Dr. W. Bray and Dr. J. G. Evans.

Students

The total number of students registered at the Institute during the session was 153; in addition 57 Intercollegiate students attended courses. Of Institute students

18 were registered for Diplomas (1 part-time); 61 for Higher Degrees (5 part-time); and 18 for the newly-instituted B.A. Hons. degree. 22 students were registered for the course in Archaeological Conservation (5 part-time); and 8 for the course in the Conservation of Historical Monuments. Five full-time and 21 part-time Occasional students attended lectures and used the facilities of the Institute.

Two students were awarded the Diploma in European Archaeology, one in section B1 (Iron Age and Roman Provinces) and one in section B2 (The British Isles in the Anglo-Saxon Period); four the Diploma in Prehistoric Archaeology; and two the Diploma in the Archaeology of Western Asia (A: Mesopotamia).

Of the 61 Higher Degree students, 30 were registered for the Ph.D. full-time (one in the Faculty of Science) and two part-time. Twenty-six were registered for the M.Phil. and M.A. (Old Regulations) full-time and three part-time. Ph.Ds. were awarded to Mr. D. Biernoff (Prehistoric Department) in December; to Mr. A. C. Pal (Indian Department) in January; Mrs. E. During-Caspers (Department of Western Asiatic Archaeology) in May and to Mr. E. D. Oren (Department of Western Asiatic Archaeology) in June.

Ten students qualified for the Institute's Diploma in Conservation (three with a mark of Distinction) and three for the Diploma in the Conservation of Historical Monuments.

Twenty-one countries were represented by 50 students registered at the Institute as follows: Australia, 2; Bulgaria, 1; Canada, 1; Chile, 1; Columbia, 1; Cyprus, 1; Denmark, 2; Germany, 1; Greece, 3; India, 2; Israel, 1; Korea, 1; Lebanon, 1; Mexico, 1; Netherlands, 1; New Zealand, 1; South Africa, 1; Sweden, 1; Thailand, 1; Turkey, 3; U.S.A., 22. The number of overseas students shows a drop as compared with recent years. The intake of students for the new first degree has been drawn almost exclusively from British applicants.

The Students' Union

With the inception of the first degree the presence of undergraduates in the Institute for the first time necessitated the establishment of a Students' Union. It was not possible in present conditions to offer the new organisation independent accommodation, but the Union benefits from affiliation to the University of London Union and to the National Union of Students. In its first year the Union played an active part in the affairs of the Institute. A number of memoranda set forth student views on matters of Institute policy and organisation and student representatives participated in the work of several Institute committees. A personal advisory service for undergraduates was also established.

The officers of the Union were:

President:	D. Price-Williams
Secretary:	Miss M. E. H. Dyk
Treasurer:	B. J. H. Clauson

Gordon Childe Prize and Bequest Fund

Gordon Childe Prizes for 1968/69 were awarded to Mr. L. Keen (Diploma in Anglo-Saxon Archaeology) and Miss S. Forbes (Diploma in Conservation).

The income from the Gordon Childe Bequest Fund for the session was applied to the purchase of equipment urgently needed by the Institute.

Margary Fund

Twenty-one students received awards to enable them to travel to Crete, Cyprus, Iran, Jordan and Turkey.

Association for Cultural Exchange Fellowship in Archaeology

The Association has undertaken to provide biennially funds to enable a young professional archaeologist from a Mediterranean country to spend a full session studying at the Institute. The first Fellow was Miss Athanasia Kanta of the Chania Archaeological Museum, Crete.

Gifts

The Hertford Museum presented £50 to the Conservation Department for the purchase of equipment in recognition of the work done by students for the Museum.

Dr. G. Caton-Thompson presented some 3/400 negatives and prints of her work at Kharga Oasis for housing at the Institute.

TEACHING AND RESEARCH

First degree in Archaeology

The new B.A. degree was instituted at the beginning of the Session and undergraduates were admitted to the Institute for the first time.

Institute Field Course

A training excavation was held at Cambridge in the Easter vacation. The course was directed by Dr. J. A. Alexander of the Extra Mural Department. Students were given instruction in excavation techniques, surveying, recording and the processing of finds, with evening seminars and study-visits to sites and museum collections in the region. At Lion Yard part of the nuclear area of the Saxon settlement of Cambridge was sampled; on the Mount Pleasant site a gate tower of the Roman town, the first to be found in Cambridge, was located and recorded.

The Institute's thanks are offered to Dr. Alexander for his help in supervising this experimental course, to his colleagues (Messrs Spratling and Scott, Miss Pretty and Mrs. Morton) who contributed to the instruction, and to Magdalen College for the loan of a hall for evening work.

A field-course was again held in north-east Yorkshire for a one week period at the end of the summer term, under the direction of the Director and Professor Dimbleby

with Professor Strong, Dr. Nandris and Miss Sheldon participating. Archaeological and environmental studies were made. The Institute's thanks are again due to Mr. T. C. M. Brewster and Mr. R. Hayes for making their local knowledge available.

Research Seminar in Archaeology and Related Subjects

Three meetings were held during the session, dealing with the following topics:

25.10.68 'Criteria to distinguish cultural phases—methods employed in the excavation at Bylany'
Paper by: Dr. Bohumil Soudský (Institute of Archaeology, Prague)
Chairman: Dr. J. Alexander (Department of Extra-Mural Studies, University of London)

6.5.69 'Aims in Prehistoric Archaeology'
Paper by: Mr. B. G. Trigger (Department of Anthropology, McGill University)
Chairman: Mr. G. de G. Sieveking (Department of British and Medieval Antiquities, British Museum)

15.5.69 'Leathers, Skins and Parchments in Archaeology'
Paper by: Mr. A. J. Cruise (Academic Press, London)
Chairman: Mr. H. W. M. Hodges (Institute of Archaeology)

In May the book *Domestication and Exploitation of Plants and Animals*, Duckworth, 581 pp. was published, being an edited and enlarged account of the proceedings of the two-day seminar held in May, 1968. The publication was edited by Dr. P. J. Ucko of University College and Professor Dimbleby and the Institute's thanks are due to them for this and for their continued responsibility for the Seminar throughout the session.

Underwater Research Group

The following meetings were held:—

October 29th. The importance of Underwater Archaeology. Underwater techniques (Stuart Swiny).

December 4th. A wreck in Cyprus and the techniques involved (Robin Piercy).

Group meetings were organised by Mr. Swiny (Diving Officer).

In the second term Miss Wylde organised a number of drawing and surveying practices for diving students in the University Union baths, which nine members attended.

The membership of the group during the session was 12.

The following were elected officers for the 1969-70 session:—

President:	Miss Kanta;
Diving Officer:	Mr. Tollinton
Secretary:	Miss Raddon

The Arabia Society

The Arabia Society, founded in early 1968, held three meetings during the session. In October Mr. P. J. Parr gave an illustrated talk on the preliminary survey of the Northern Hejez which he and Mr. J. E. Dayton had carried out; in January a one-day seminar was held at the Institute, a summary of which will be published in the Institute *Bulletin;* and in June a symposium was held in Cambridge in association with the Middle East Centre at which problems of mutual interest were discussed.

Association for Students in the Conservation of Historic Buildings

On 1st November, 1968 this Association was formed by past and present staff and students of the course in the Conservation of Historic Monuments, and its inaugural meeting was held at the Institute on 4th December. Professor Grimes agreed to become the President, with Miss Corinne Wilson, Hon. Secretary and Mr. Brian Young, Hon. Treasurer.

The Association aims to bring together architects and members of other professions engaged in the conservation of historic buildings, by holding bi-monthly meetings alternating with a bi-monthly news-sheet for exchange of information and technical memoranda. Transactions will be published.

In June 1968 a report was issued to all individuals and groups connected with ancient monuments and historic buildings on Training for Conservation.

The following papers were given during the session.

Professor W. F. Grimes: 'The Excavator's Contribution to Building History'
Mr. Ashley Barker: 'The Town and Country Planning Act, 1968'
Miss Pamela Pratt: 'Conservation of wall-paintings'

Two visits also took place to buildings under repair:
Hughenden Manor, High Wycombe
Church of All Saints, Windsor
West Wycombe Park

THE DEPARTMENTS

The Director again served as External Examiner for Nottingham University. He continued to advise on the ancient defences of London in the Barbican area of the City.

He gave a number of outside lectures.

The following student continued to work under the Director's supervision:

M.Phil.

E. M. Holt, Miss (Faculty of Arts): Study of ancient fields (medieval) with specific reference to early estate maps in the Pennine District.

Publications:

By the Director:

'On Co-operation', Ucko and Dimbleby (edd.) *The Domestication and exploitation of Plants and Animals* (1969), XXIII—XXVI.

By Mr. Pyddoke (with M. Maitland Howard and H. W. M. Hodges):

Ancient Britons

John Baker 1969, 94 pp.

Changes in academic administration during the session added materially to the work of the Registry. In addition to participation for the first time in the UCCA scheme, with the introduction of the first degree the Registrar became responsible for tasks in connexion with the registration of higher degree students which were previously performed centrally by the University. There were changes also in accounting systems to meet central requirements.

HUMAN ENVIRONMENT

Professor:	G. W. Dimbleby, B.Sc., M.A., D.Phil. (Oxon) (*A.T.*)
Reader:	I. W. Cornwall, Ph.D. (*A.T.*)
Lecturer:	Miss J. M. Sheldon, B.Sc. (*R.T.*)
Research Assistants:	J. G. Evans, Ph.D.
	M. C. D. Speight, Ph.D.
Chief Technician:	P. Porter
Technician:	G. Sansom
Honorary Assistants:	Mrs. M. Barton
	Mrs. H. Jones

Three students continued their Ph.D. studies during the year, namely:

C. Banks, Mrs. (*née* Grigson) (Faculty of Science): Prehistoric cattle remains from Europe and India

A. Kosse (Faculty of Arts): Pedological investigation of settlement sites (joint registration with Professor Evans)

D. Mathewson (Faculty of Arts): Weathering processes on archaeological objects.

In addition to these students, Mr. John Hollin worked in the department as part of his course for the Ph.D. at Princeton University.

The research on molluscs and insects from archaeological sites was continued by Drs. Evans and Speight respectively, with the aid of grants from N.E.R.C. Both they and Professor Dimbleby worked on material from Silbury Hill; preservation of insect and plant remains was unexpectedly good, and mollusc shells were also found in the more calcareous parts of the mound. Dr. Cornwall studied the soil problems from the same site.

The Professor and Dr. Evans continued their joint investigation into Neolithic sites in Wiltshire and Oxfordshire, concentrating particularly on pollen analysis, molluscan analysis and pedology,

A number of specialist environmental analyses were made and reported on by all members of the staff in connexion with archaeological sites currently being investigated by other workers.

At the Dundee meeting of the British Association for the Advancement of Science, Professor Dimbleby led a study group on 'Buried Soils', a new venture designed to bring together research workers from different fields. The Professor, Dr. Cornwall and Dr. Evans also gave a number of outside lectures in the course of the year and they and Miss Sheldon took part in some Extra-Mural courses of the University of London.

Publications:

By Professor Dimbleby:

The following Specialist reports:

'Seven Prehistoric sites near Honiton, Devon, Part I' by Sheila H. M. Pollard, *Proc. Devon. Arch. Soc.* 25 (1967), p. 29

Excavations at Shakenoak, I, by A. C. C. Brodribb, A. R. Hands and D. R. Walker (privately printed, Oxford) (1968), p. 108

'Excavations in the Iron Age Hill-fort at High Rocks, near Tunbridge Wells, 1957-61' By J. H. Money, *Sussex Arch. Soc.* 106 (1968), 193-7.

'Ivinghoe Beacon Excavations 1963-5', by M. A. Cotton and S. S. Frere, *Rec. Bucks.* 18 (1968), 250-1.

'Pen Llystyn: A Roman Fort and other remains' by A. H. A. Hogg, *Arch. J.* 125 (1969), 188-191.

By Professor Dimbleby (with P. J. Ucko, eds.)

'*The Domestication and Exploitation of Plants and Animals*, Duckworth 1969, 581 pp.

By Dr. Cornwall:

'Outline of a stratigraphical "bridge" between the Mexico and Puebla basins', *Bull. Inst. Arch.* 7 (1967), 89-140.

By Dr. Evans:

'Periglacial deposits on the Chalk of Wiltshire', *Wilts. Arch. and Nat. Hist. Mag.* 63 (1968), 12-26.

'The exploitation of molluscs' in *The Domestication and Exploitation of Plants and Animals*, ed. P. J. Ucko and G. W. Dimbleby, Duckworth (1969), 479-484.

PREHISTORIC ARCHAEOLOGY

Professor: J. D. Evans, M.A., Ph.D., F.S.A. (*A.T.*)

Lecturers: J. d'A. Waechter, Ph.D., F.S.A. (*R.T.*)
F. R. Hodson, M.A., Ph.D., F.S.A. (*R.T.*)
J. G. Nandris, B.A., Ph.D. (*R.T,*)

Lecturer in Latin American Archaeology: W. M. Bray, Ph.D., M.A., F.S.A. (joint post with Institute of Latin American Studies) (*R.T.*)

Special Lecturer: T. Sulimirski, Iur.D., Ph.D. (Lwow), Hon. F.S.A.

Honorary Assistant: Mrs. B. Kulesza

Nine full-time students were registered for the Postgraduate Diploma, six of whom were in their second year. There were also seven students registered for the B.A. Of the second year Diploma students, four sat the examination and one withdrew owing to illness. Three of these candidates were awarded the Diploma. A fourth Diploma was awarded to a candidate who had withdrawn the previous year and now sat the examination without having repeated the course.

Teaching was also provided for 5 full-time occasional students and 11 inter-collegiate students.

There were 29 students registered for higher degrees in the Faculty of Arts, as follows:—

Ph.D.

I. Azoury, Mrs.: A technological and typological analysis of the Transitional and early Upper Palaeolithic levels at Ksâr 'Akil and Abu Halka.

G. H. A. Bankes: Some aspects of the Moche Culture.

D. C. Biernoff: An analysis of the earliest painted design motifs on pottery from western Anatolia and Greece.

I. M. Crawford: Late prehistoric changes in aboriginal cultures in Kimberley, Western Australia.

C. Doumas: Some cemeteries of the early Bronze Age in the Cyclades and their significance for the Cycladic early Bronze Age.

A. D. Kosse: Pedological investigation of settlement sites (joint registration with Professor Dimbleby).

M. Lev: The Palaeolithic: a method of determining differences between assemblages.

M. H. Newcomer: An analysis of a series of burins from Ksâr 'Akil (Lebanon).

R. R. Newell: The Mesolithic affinities and typological relations of the Dutch Band-keramik Flint Industry.

W. W. Phelps: The Neolithic sequence in southern Greece.

A. P. Phillips, Miss: An analysis of the southern French Chassey culture and its relationship to the Cortaillod and Lagozza cultures.

R. C. Reed: Cornwall in the Neolithic and Bronze Age (with a special section on the trade in Neolithic implements of Cornish source).

H. C. Ridley, Mrs.: (Field of proposed research) The later Neolithic period in Macedonia.

M. J. Rowlands: A study of the bronze-working industries of the Middle Bronze Age in southern Britain.

M. G. Spratling: Southern British decorated bronzes of the late Pre-Roman Iron Age.

D. P. Heldman: Archaeological relationship between interior and coastal regions of the Huasteca, Mexico.

A. J. Ammerman: (Field of proposed research) Transition from Mesolithic to Neolithic period in Italy.

M.Phil. and M.A. (Old Regulations)

E. Bader: (Field of proposed research) Levantine influences in the Early and Middle Bronze Ages in the Aegean basin (joint registration with Mr. Parr).

B. M. Beeby (*part-time*): La Tène cultures of the Carpathian Basin with particular attention to trade and economy.

G. P. Diamond: (Field of proposed research) Neolithic Crete and the connections with the Greek mainland.

C. Dortch: A typological analysis of some late Aurignacian levels from Ksâr 'Akil.

N. P. Evans, Mrs. (*née* Figgis): The development of the early British Neolithic with special reference to the Western Province.

I. Harrison, Mrs. (*née* Haglund): Connections between Scandinavia, Russia and the British Isles from the Neolithic to the Early Iron Age.

J. W. Haldane: The study of iron-work from pre-Roman sites in the south-west of England (joint registration with Mr. Hodges).

A. McCord, Miss (*part-time*): (Field of proposed research) Palaeolithic archaeology—a statistical survey of an assemblage of flint tools.

F. F. Petersen: The Neolithic and Bronze Age of East Yorkshire.

K. A. Wardle: (Field of proposed research) The Greek Bronze Age and, in particular, the areas of Epirus and Aetolia.

J. M. Willoughby, Miss: (Field of study) Pre-historic Archaeology.

R. G. Cooke: (Field of proposed research) Middle American Archaeology.

Mr. Biernoff submitted his thesis in the course of the session and was awarded the Ph.D. degree.

Professor Evans conducted a programme of excavations in the neolithic settlement at Knossos, Crete from July to September. He gave some outside lectures and continued to act as an External Examiner for the University of Birmingham.

Dr. Bray received a Leverhulme Research Award for the study of pre-Spanish metallurgy in Colombia, and spent part of the summer studying museum collections in Paris and Madrid. He gave a number of outside lectures, and acted as script consultant for a television documentary programme on the conquest of Mexico.

Dr. Hudson took part in an International Conference on 'The use of computers in archaeology', C.N.R.S. Marseilles, 7-12 April, 1969. During the year he developed and tested further programmes for archaeological classification on the London University Atlas Computer (including double-link and K-means cluster analyses). At the request of the Secretary of the Royal Statistical Society, and in collaboration with the Department of Pre-historic and Romano-British Antiquities of the British Museum, he organised an exhibition in the British Museum on *Statistics in Archaeology*, to run from September 1969 to January 1970. He acted as External Examiner in archaeology at the Queen's University, Belfast.

Dr. Nandris acted as Assistant Director of the excavations in the Neolithic settlement at Knossos, and afterwards spent a few weeks working in museums and visiting sites in Bulgaria and Yugoslavia.

Dr. Waechter continued his excavations at Swanscombe during the Long Vacation from late June onwards.

Publications:

By Professor Evans:

Various reviews.

By Dr. Hodson:

The La Tène cemetery at Münsingen-Rain: Catalogue and Relative Chronology, Stämpfli, Berne, 1968, 72 pp.

'Archaeological classification', *Some research applications of the computer*, 1968 (Atlas Computer Laboratory), 63-67.

'Searching for structure within multivariate archaeological data', *World Archaeology* I, no 1 (1969), 90-105.

Various reviews.

By Dr. Waechter:

'Swanscombe 1968', *Proceedings of the Royal Anthropological Institute of Great Britain and Ireland*, 1968, 53-62.

'The evidence of the Levallois technique in the British Acheulian and the question of the Acheulio-Levallois', *La Préhistoire, Problèmes et Tendances*, 1968, Editions du Centre National de la Recherche Scientifique, Paris, 491-497.

'The Lower Palaeolithic Age', *Victoria County History Middlesex* I, 1969, 11-20.

By Dr. Waechter (with L. Copeland):

'The Stone Industries of Abri Bergy, Lebanon', *Bull. Inst. Arch.* 7 (1967), 15-36.

By Dr. Nandris:

Various reviews.

By Dr. Bray:

Various reviews.

ARCHAEOLOGY OF THE ROMAN PROVINCES

Professor: D. E. Strong, M.A., D.Phil., F.S.A. (*A.T.*)

Lecturer: M. W. C. Hassall, M.A. (*R.T.*)

There were 20 students in the Department, two of whom were registered for the Postgraduate Diploma, 12 for Higher Degrees (3 part-time). Two occasional students attended the course on Roman Britain. The one second-year Diploma student successfully took the examination in June. The lecture course on Roman Britain given by the Professor and Mr. Hassall was attended by 23 intercollegiate students.

Ph.D.

J. P. Alcock, Miss (*part-time*): Classical cults in Roman Britain.

M. W. C. Hassall: The *Notitia Dignitatum*.

W. H. Manning (*part-time*): Objects of iron in Roman Britain.

S. E. Ramsden, Miss: Roman mosaics in Greece.

P. V. Webster: Romano-British pottery of the West and North Midlands.

R. Goodburn: A systematic survey of the development and history of the Roman villa in Britain.

J. C. Hanson, Miss: Water supply in Roman Britain.

M.Phil.

H. Chapman: Itineraries and Posting Stations.

S. K. Digby (*part-time*): Coin reforms of Aurelian and their effect on Roman Britain.

H. R. Hurst: Roman villas in the Bath area.

M. Roxan, Mrs.: The Auxilia of the Roman Army.

J. Sampson, Mrs.: Hellenistic and Roman Landscape Relief.

A number of outside speakers participated in the work of the Department during the year. Dr. Kent of the British Museum gave two lectures on Roman coins in the Easter term, and six guest speakers conducted joint seminars with the Conservation Department on 'Roman Craftsmen and their Techniques' held during the Summer term.

The Professor gave outside lectures at the Universities of Birmingham, Exeter and Leeds, the Courtauld Institute and elsewhere. During the Easter vacation he was guest Lecturer on one of the Spring Cruises organised by the Hellenic Travellers Club. He served on the Councils of the Royal Archaeological Institute and the Roman Society and was appointed Chairman of the Libya Exploration Society. He acted as Examiner to the Boards of Postgraduate Studies at Oxford and Cambridge. During the summer he took part in excavations carried out by the City Museum in Gloucester.

Mr. Hassall took part in excavations at the site of Germa in the Fezzan, conducted by Mr. C. M. Daniels of Newcastle University during the Easter vacation and acted as Assistant Field Director in the University of Long Island's excavations at Knidos during the Summer, when he was accompanied by four students from the Institute. In August and September he attended the 8th Congress of Roman Frontier Studies and the 9th Pilgrimage to Hadrian's Wall. He has been appointed by the Haverfield Trust as Assistant Editor of the Roman Inscriptions of Britain.

Publications:

By Professor Strong:

'The Administration of Public Building in Rome during the Late Republic and Early Empire', *Bulletin of the Institute of Classical Studies* 15 (1968), 97-109.

'The Head of an Old Woman', *Hommages à Marcel Renard* III (Collection Latomus, vol. 103), 542-9.

WESTERN ASIATIC ARCHAEOLOGY

Professor: Seton Lloyd, C.B.E., M.A., F.B.A., F.S.A., A.R.I.B.A. (*Retd.*) (*A.T.*)
Lecturer in Mesopotamian Archaeology: Miss Barbara Parker, O.B.E., F.S.A. (*R.T.*)
Lecturer in Palestinian Archaeology: P. J. Parr, M.A., F.S.A. (*R.T.*)
Lecturer in Anatolian Archaeology: J. Mellaart, B.A., F.S.A.
Seminar in Metallurgy and Metal Typology: Mrs. K. R. Maxwell-Hyslop, F.S.A. (*R.T. Retd.*)

The number of full-time students in the Department was 25, of whom three were reading for the B.A. Degree and four for the Post-graduate Diploma in the Archaeology of Mesopotamia. Two students were reading for the B.A. Degree and one for the Post-graduate Diploma in the Archaeology of Palestine. One student was reading for the Post-graduate Diploma in the Archaeology of Anatolia.

Two students were successful in the examination for the Diploma in Mesopotamian Archaeology.

Students registered for higher degrees in the Faculty of Arts were as follows:

Mesopotamia

Ph.D.

E. D. Caspers, Mrs.: Archaeological evidence for Maritime Trade in the Persian Gulf in the 3rd millennium B.C.

M.Phil. and M.A. (*Old Regulations*)

D. S. Noble (*part-time*): The development of transport in ancient Mesopotamia.
P. Razavi, Miss: Achaemenid art in the Western Provinces.

Palestine

Ph.D.

E. Oren: The Bronze Age cemeteries of Beth Shan.
H. Seeden, Miss: The Phoenician standing deity or warrior figurines and related types during the second millennium B.C.

M.Phil.

J. E. Dayton: Ancient irrigation and the Arabian peninsula.
D. C. Elliott, Miss: The Ghassulian culture of Palestine.
R. Henry, Mrs.: Architecture of Palestine and Syria in the Late Bronze and Iron Ages.
V. Izon, Miss: Archaeological evidence for the period of the *Judges*.
D. Price Williams: Application of statistical methods to some problems of the Middle Bronze Age in Palestine.
M. Saghieh, Miss: Byblos in the third millennium B.C.

Anatolia

Ph.D.

O. Bilgi: Development and distribution of anthropomorphic figurines in Anatolia from the Neolithic to the end of the Early Bronze Age.

M.Phil.

W. M. N. Campion: The relations between Anatolia and neighbouring countries in the Second Millennium.

E. R. Jewell, Miss: Burial customs in Anatolia.

J. H. Pullar, Miss: Neolithic in the Zagros Mountains.

Mrs. During Caspers and Mr. Oren presented their theses in July and were awarded doctorates.

Mr. Parr was granted leave of absence in the autumn to carry out a photogrammetric survey of the Petra tomb façades, in conjunction with the Department of Photogrammetry, University College. He later visited the Department of Antiquities and the Government museum in Riyadh, in connection with his survey of N.W. Saudi Arabia.

Mr. Mellaart was granted leave of absence in the spring to attend a symposium on the ethnogenesis of the Balkan peoples at Plovdiv in Bulgaria. With the aid of a Hayter grant the summer was spent in Turkey in preparing the publication of material from Catal Hüyük.

Dr. Clare Meade (*née* Goff) continued her excavations in Luristan under the auspices of the Institute.

Publications:

By Mr. Parr:

'Découvertes récentes au sanctuaire du Qasr à Pétra: compte rendu des derniers fouilles', *Syria* XLV (1968), 1-24.

By Mr. Mellaart:

'Anatolian trade with Europe and Anatolian geography and cultural provinces in the Late Bronze Age', *Anatolian Studies* XVIII, (1968), 187-202.

DRAWING AND SURVEYING

Lecturer: H. M. Stewart, B.A. (*R.T.*)

The number of students attending the course was 42 (13 First Degree, 4 Higher Degree, 8 Diploma, 8 Conservation, 9 Occasional).

Two concurrent courses in Archaeological Surveying were given in the Extra Mural Department in order to meet exceptionally heavy enrolments.

With the kind co-operation of Professor E. H. Thompson, the Lecturer attended a course in Photogrammetry in the Department of Photogrammetry and Surveying, University College. It is proposed eventually to include an introduction to this subject in the Institute's curriculum in Archaeological Surveying.

PHOTOGRAPHY

Visiting Lecturer: S. K. Matthews
Senior Technician: Mrs. M. V. Conlon

Forty-five students attended the course, 27 Diploma and First-degree and 18 Conservation.

Mr. Mark Hilton of the Percival David Foundation attended the course to enable him to supervise the photographic work for Professor Watson's expedition to Tha Muang, Uthong, Suphanburi Province.

The Department's thanks are due to the Guildhall, the Natural History and the Victoria and Albert Museums for permission to take photographs of objects in their collections; to the Guildhall Museum also for facilities to work on Mr. Marsden's excavation in Billingsgate in the City; and to the Principal of the London School of Printing for enabling parties of students to visit the block-making departments of the School under the guidance of Mr. Parish.

The annual exhibition of students' work was held in July.

Visitors to the Department included H. E. Abdul Aziz Gibril, Under Secretary of State for Antiquities, Libya; Mr. C. O'Méadhra, University of Dublin, Mr. Walker, University of Oxford and Mr. Durnley, Harrow Technical College. The Department advised, acquired equipment and assisted generally over specialised photography for the excavations at Knossos.

CONSERVATION

Senior Lecturer-in-charge: Miss Ione Gedye, B.A., F.I.I.C. (*R.T.*)
Senior Lecturer: H. W. M. Hodges, F.I.I.C. (*R.T.*)
Assistant: Miss P. Pratt
Honorary Assistant: Miss A. Plowden

Twenty-seven students attended courses in the Department of whom twenty-two followed the Conservation course, eight being in their second year and five part-time.

The Department's thanks are again due to Dr. A. E. Werner, Keeper of the Research Laboratory of the British Museum, both for acting as External Examiner and for help in other ways; and also to Mr. Baines-Cope of the same Department for instruction in the technology, decay and conservation of paper.

As in previous years work of instructional value to students was undertaken for a number of museums and institutions. This included the treatment of Etruscan bronzes damaged in the floods in Florence which were entrusted to the department by the Archaeological Museum through the Italian Art and Archives Fund. The Department was also entrusted by the York Minster Excavation Committee with the treatment and conservation of the transferred paint which was discovered under the effigy of Archbishop de Gray in the Minster. Treatment presented many unusual problems because of the condition of the materials and involved prolonged tests before the work could proceed.

Mr. B. Arthur attended the course as the first student to sit the examination for the Museums Association Certificate in Conservation, which he passed, obtaining Distinction.

Miss M. Bacon, Miss M. Dyk, Miss S. Forbes, Mr. C. Hett, Mr. D. Plunket Green, Miss C. Room, Miss F. Talbot, Mr. P. van Geersdaele and Mr. I. McIntyre were awarded the Diploma in Conservation. Miss Forbes, Mr. Hett and Miss Talbot obtained Distinction. Mr. van Geersdaele and Mr. McIntyre were the first part-time students from the British Museum to take the examination.

As an experiment during the Easter vacation first year students worked in Conservation Departments in the British and London Museums and in the Oxford and City County Museum. This proved a success and will in future be a normal part of the course.

Miss Gedye and Mr. Hodges again lectured on the examination and conservation of pottery for an Extra-mural course and to the Museums Association course for archaeologists.

With Miss Pratt they took part in a British Council course for foreign conservators, lecturing on the conservation of water-logged wood, metals and wall paintings.

Miss Pratt again worked on the mud plaster mural paintings in the Hittite Museum at Ankara, having in the previous summer conducted tests as to methods of mounting the paintings.

Miss Plowden visited New York to advise on emergency treatment to antique bronzes in the Rockefeller Collection.

Vacation work was carried out by students in Libya, Crete, Turkey, Italy, Cyprus, Iran and England (Dragonby and Swanscombe).

A one-term seminar in preservation dealing with decay of organic and non-organic materials under burial conditions was held jointly with the Department of Human Environment.

Publications:

By Miss Gedye:

'Pottery and Glass', *The Conservation of Cultural Property—Museums and Monuments* XI, UNESCO, 1968, 119-125.

By Mr. Hodges:

Ancient Britons (with M. Maitland Howard and E. Pyddoke), John Baker, 1969, 94 pp.

'Equipping a Laboratory', *The Conservation of Cultural Property—Museums and Monuments* XI, UNESCO, 1968, 86-99.

CONSERVATION OF HISTORICAL MONUMENTS

Lecturer-in-Charge: (*part-time*) W. A. Eden, M.A., F.S.A., F.R.I.B.A. (Theory of Architecture).

Lecturers: (*part-time*) B. Ashley Barker, A.R.I.B.A., F.S.A. (Law relating to Ancient Monuments)

Mrs. M. P. G. Draper, B.A., F.S.A. (Documentary Sources for the History of Architecture in England. Local and Private Records)

N. Harrison, A.R.I.B.A., F.S.A., (Diagnosis and Treatment of Structural Faults in Buildings)

Dr. P. Kidson, M.A., Ph.D., F.S.A. (English Architecture from 597-1540)

Sir John Summerson, B.A., F.B.A., F.S.A., A.R.I.B.A. (English Architecture from 1540).

The work of the session was overshadowed by the prevailing uncertainty about the future of the course owing to the increase in fees made necessary by the cessation of the Gulbenkian grant. This increase has effectually limited recruitment almost entirely to students sponsored by the Ministry of Public Building and Works or the Greater London Council.

Of the eight students within the Department during the session the three first-year students were sponsored by the Ministry of Public Building and Works, the Greater London Council being unable owing to restrictions on recruitment to sponsor any; two of the five students enrolled in the second year were sponsored by the Greater London Council and a third was an architect in private practice of some years' standing. The remaining two have so far proved unable to meet their dues.

Three candidates presented themselves for the Diploma Examination; a fourth was allowed to sit certain of the papers. All satisfied the examiners.

An Association for Studies in the Conservation of Historic Buildings made up of past and present students was formed during the year. The Association held a number of meetings at which papers were read; its members also produced a memorandum setting forth their views on the general problems of training in building conservation.

Discussions were begun with interested parties, including the Ministries of Housing and Local Government and of Public Buildings and Works, on the reorganisation of the course in the light of the experience of the past eight years. Problems of financing the course until such time as it becomes possible to incorporate it fully into the Institute's teaching programme were also discussed.

Negotiations are proceeding with interested bodies in the hope of resuming recruitment in October 1970.

Mr. Norman Harrison completed the restoration of the Adam Library at Kenwood House, and a new edition of Florence Gladstone's *Notting Hill Gate in By-gone Days* with additional material by Mr. Ashley Barker was published in November 1969.

LIBRARY

Librarian:	Miss J. du Plat Taylor, F.S.A.
Assistant Librarians:	Miss G. Talbot, M.A., A.L.A.
	Miss H. M. Bell, B.A.
Collections Clerk:	Miss J. Philips, B.A.

The major part of the revision of the Classification and Indexes was completed. A start was made on re-labelling, new shelves were erected in the basement store and some duplicate material was stored there.

Miss Jennifer Pool, a library student from Leeds, assisted in the library during November and December.

The Librarian visited Southern Italy at Easter to make plans for a summer excavation and a regional survey, which she directed during August and September on behalf of the British School at Rome.

The following is a summary of the additions made during the year:

Books		572	*Pamphlets*		439
Exchanged	99		Exchanged	106	
Presented	175		Presented	204	
Purchased	208		Purchased	120	
Periodicals		430	*Volumes bound*		257

Volumes lent totalled 4,821, the highest month being November (665) and the lowest August (149). Sixty-five works were borrowed from outside libraries and forty lent.

The following have presented books, periodicals and pamphlets:
Dr. P. B. Adamson; L. Alcock; Dr. J. Alexander; Dr. E. Anati; Society of Antiquaries of London; A. M. ApSimon; Dan Barag; Mrs. M. Barton; Barry Beeby; Belgrade, Arkheoloski Institut; Belgrade, National Museum; F. G. Gilbert Bentley; Mrs. Biro; Dr. Warwick Bray; British Archaeological Association; Dr. Marie-Louise Buhl; California University Archaeological Research Facility; Dr. George F. Carter; Jean Chavaillon; Prof. Desmond Clark; H. Dunscombe Colt; Mrs. Copeland; Dr. I. W. Cornwall; Costantsa, Archaeological Museum; Dr. J. D. Cowen; D. H. D'Arcy; A. P. Detsicas; Dillons University Bookshop; D. T. Donovan; Christos Doumas; Editor of *Endeavour:* W. A. Evans; Dr. Geza Fehervari; Dr. Henry Field; French Embassy; Miss H. Fuller; Miss I. Gedye; Prof. P.-R. Giot; Prof. W. F. Grimes; Hon. Mrs. Henry Hankey; Hans-Ole Hansen; Viscountess Hanworth; Dr. D. B. Harden; Helsinki Bureau of Maritime Archaeology; Prof. C. F. W. Higham; H. W. M. Hodges; Dr. F. R. Hodson; IBEG Ltd.; I.N.A.H.; Israeli Embassy; Lawrence Keen; Dr. K. M. Kenyon; Prof. Won Yong Kim; Alan Kosse; Lagos, Director of Antiquities; Executors of the late Winifred Lamb; Institute of Latin-American Studies; Prof. Sir Max Mallowan; Robert F. Marx; R. J. Mason; Meiji University; P. Mellars; Dr. Robert S. Merrillees; Dr. John Nandris; Dr. K. P. Oakley; Hideo Ogawa; P. J. Parr; David Philips; Edward Pyddoke; Miss Sheila Rudd;

Dr. J. R. dos Santos, Junior; Dr. T. C. Sharma; G. Herbert Smith; Robert H. Smith; Miss Ruth Streiff; Prof. D. E. Strong; Prof. T. Sulimirski; Miss G. C. Talbot; J. V. C. Talbot; Miss J. du Plat Taylor; Dr. Peter J. Ucko; Dr. C. Vita-Finzi; Sir Mortimer Wheeler; G. R. H. Wright.

STUDENTS' APPOINTMENTS

Miss Frances Bacon: Conservator, National Museum, Copenhagen.

Miss Marion Bacon: Temporary Assistant Conservation Officer, British Museum.

Mr. H. Chapman: Museum Assistant, Guildhall Museum, London.

Mr. John Curtis: Fellow of the British School of Archaeology in Iraq.

Miss M. Dyk: Area Conservation Officer for the Area Museums' Council for the South-West.

Miss S. Forbes: Conservation Officer, Winchester Excavations.

Mr. C. Hett: Conservation Officer, Instituto Nacional de Antropologia e Historia, Mexico City.

Mr. D. Parish: Archaeological Assistant, South African Museum of Natural History.

Miss C. Room: advised on conservation work in Libya and the setting up of a conservation workshop under the auspices of the British Council, followed by conservation work at various excavations in Turkey.

Miss Nan Shaw: Part-time Conservation Officer in Department of Western Asiatic Studies, British Museum.

Miss F. Talbot: Conservation Officer to the underwater excavation at Kyrenia, Cyprus.

Mr. P. V. Webster: Staff Tutor, Extra-Mural Department, University College, Cardiff.